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NEWSLETTER OF AUTOMATIC DATA
PROCESSING IN DENTAL EDUCATION

School of Dentistry
University of North Carolina
Chapel Hill, North Carolina

Volume 1, Number 1

Spring 1973

HEALTH SCIENCES
LIBRARY
JUL 26 1973

lew Newsletter

DE SUPPORT ENABLES PUBLICATION OF
WSLETTER ON EDP IN DENTAL EDUCATION

new publication begins with this sue of CYBERDENT, the Newsletter of tomatic Data Processing in Dental ucation. The purpose of the wsletter is to provide a medium of change for information on data ocessing in dental education. The ea for the publication originated the Workshop Session on Data ocessing at the Conference on mprehensive Care in Clinical Dental ucation which was held in Southern nes, North Carolina in June 1969.

itially, the Newsletter will be blished quarterly. Should the need ise, publication may become more equent. Perhaps eventually, it ght become a journal, as dental ucation becomes more involved in e use of computers and automated thods.

blication is made possible by a ree-year grant from the American nd for Dental Education. It will published by the Dental Data nter, University of North Carolina Chapel Hill. Dr. C. E. andell, Director of the Center, ll act as Editor. Associate Editor r Automated Instruction is Dr.

(see AFDE, p. 4, col. 2)

CAI at Ann Arbor

CAIDENT PROJECT UNDERWAY AT MICHIGAN

The School of Dentistry at The University of Michigan has been awarded a five-year grant by the Bureau of Health Manpower Education to design, develop, and deliver individualized instructional materials to dental students. The effort has been named the CAIDENT (Computer-assisted instruction, Audio-tutorial teaching, Individualized learning in DENTistry) Project.

The computer will play a major role in at least three areas: teaching, guiding student progress, and testing. According to the project director, William F. Fitzgerald, students will be able to go to a computer terminal for primary instruction via computer-assisted instruction (CAI). "Materials are now being developed in-house, but we have recently joined the Lister Hill CAI network and are demonstrating Ohio State's programs to our faculty. As the project progresses we hope to share courses with other schools," Fitzgerald said.

"Since we are planning for as flexible an individualized curriculum as possible," Fitzgerald explained,

(see CAIDENT, p. 5, col. 2)

ANOTHER NEWSLETTER?

An Editorial

Another Newsletter? Why? Elsewhere in this issue an article describes the purpose of CYBERDENT very well. But the real reason behind this publication is economic. The logistics of keeping records in dental schools and dental practices approaches requiring automation. Automation is often very expensive, yet it is impractical to collect or process some types of data by manual means. The administrator of a dental school is therefore faced with two alternatives: (1) he can automate his information processing, or (2) he can do without the information. A look at his budget may decide the issue for him.

The current emphasis on comprehensive care and third-party payment for dental services magnifies the problem. Reluctantly, the administrator comes to realize that he must automate and must set aside the money to fund it. After a brief experience, another fact of life in the modern world becomes painfully apparent - computers have an insatiable appetite for money. To return to the old, manual methods of keeping records at this point is unthinkable. But what is the poor man to do?

This country is not so wealthy that it can afford to have each dental school (or other health facility) hire some systems people, employ a group of computer programmers, buy a large computer, and spend huge sums of money developing "unique" data processing systems, when in reality such systems are not unique, only different.

The real reason behind CYBERDENT then is to prevent the wasting of millions of dollars on wholesale duplication of efforts in information processing by spreading the word around on who has done what. A little where, when, how, and why should complete the task, the same as for any other news publication.

CYBER—MEETINGS

American Association of Dental Schools, April 8-11, 1973, Washington, D.C. Contact: AADS, 1625 Massachusetts Avenue, N.W., Washington, D.C. 20036.

International Association for Dental Research, April 12-15, 1973, Washington, D.C. Contact: IADR, 211 East Chicago Avenue, Chicago Il 60611.

Assn. For Educational Data Systems Annual Convention, April 16-19, New Orleans. Contact: P. L. McCreary, Jr., Bossier Parish School Board, 2500 Viking Dr., Bossier City, LA 71010, 318/746-6890.

ASIS Mid-Year Regional Conference, April 26-27, Minneapolis, in conjunction with the Fourth Symposium of the Minnesota Chapters of the American Society for Information Science and the Special Libraries Assn. Contact: Jack King, Library, Hamline Univ., St. Paul, MN 55101, 612/641-2373.

5th Annual ACM Symposium on Theory of Computing, April 30 - May 2, 1973, Austin, Texas. Contact: ACM, 1133 Avenue of the Americas, NY 10036.

Operations Research Society of America, May 9-11, 1973, Milwaukee, Wisconsin. Contact: Dave Halloran (414-273-4000).

1973 National Computer Conference and Exposition, June 4-8, 1973, New York City. Contact: AFIPS, 210 Summit Avenue, Montvale, NJ 07645.

Fourth International Conference on Computers in the Undergraduate Curricula, June 18-20, 1973, Claremont, California. Contact: Fred Weingarten, The Claremont Colleges, Claremont, CA 91711.

XX International Meeting, The Institute of Management Sciences, June 24-29, 1973, Israel. Contact: TIMS XX, Box U, Brookline, MA 02146.

(see CYBERMEETINGS, p. 6, col. 2)

Admissions Automated

THE USE OF COMPUTERS FOR THE DISSEMINATION OF INFORMATION TO THE ADMISSIONS COMMITTEE AT STONY BROOK

Computers are usually thought of as being used to perform extensive and complex mathematical calculations and to solve numerical problems that are beyond man's calculating ability. While it is true that this indeed was the first use of computers, these machines in recent years have been applied in many areas that do not involve sophisticated mathematical techniques. These applications can be generally classified as "information processing," and the results and outputs of this application is usually in the form of reports and other documents that are meant to be computers are being used in this information processing mode used by people for information purposes.

At the School of Dental Medicine at SUNY at Stony Brook, the computer is used to prepare and disseminate information for use by the Admissions Committee as part of their evaluation procedure for the selection of students for the school.

Stony Brook is a participating member in the AADSAS centralized application service. Through this service, the school receives a folder for each applicant with pertinent biographical information, college transcript in a standardized format and the DAT scores, if the applicant's scores were available to AADSAS at the time his application was processed. This folder is meant to be used to hold letters of reference, copies of official transcripts and other pertinent information relative to the applicant. This folder and its contents are kept on file in the Office of Student Services of the Health Sciences Center. To prevent loss of any of the enclosed documents, this folder, in general, is not to be removed from the Office of Student Affairs, although it is always available for review by any qualified member of the faculty.

Based on an evaluation of the applicant's past academic record and DAT results, a group of applicants is selected to be interviewed by members of the faculty of the dental school. The selection of applicants to fill the class is then made by the Admissions Committee, who collectively review the applicants' records and interview results.

Since there is only one copy of the master application record, which cannot be removed from the Admissions Office, some means had to be devised to disseminate the information about the applicants who are being considered for the class to both the interviewers and the Admissions Committee.

Using a copy of the master tape of all applicants to Stony Brook which was obtained by arrangements with AADSAS, a condensed "copy" of the information contained on the application folder was prepared on a single page of standard size computer print-out paper.

A copy of this computer print-out was sent to each interviewer prior to the scheduled time of the interview so that he would have some knowledge as to the applicant's background. Provisions were made to include the results of these interviews on the tape-copy used at Stony Brook.

Prior to each Admissions Committee meeting, copies of the records of these students who were to be considered at the forthcoming meeting were distributed to each committee member so that he would be familiar with the applicant's record at the time of the meeting.

The applicant reports were grouped into the following categories:

1. Those applicants coming up for committee review for the first time;

2. Applicants that were rated "tentatively accepted" at a prior meeting;

3. Applicants that were placed in a "hold" status for further considerations, and

(see SHAKUN, p. 4, col. 1)

SHAKUN (from p. 3)

4. Applicants who were offered a position in the class, and their response to the offer (i.e. Accepted or declined.)

In addition, summary statistics were prepared which gave an overall profile of the entire applicant pool with respect to their academic and DAT performance, and was broken down into the following groups:

1. Total number of applicants,

2. Number of applicants selected for interview,

3. Results of committee action (i.e. Reject, hold, tentative accept, final accept, etc), and

4. Number of applicants who accepted a position in the class after having received on offer by Stony Brook.

This endeavor, which required the joint cooperation of the Office of Student Admissions and the Admissions Committee of the School of Dental Medicine, proved to be very useful in that all people concerned with the selection of applicants for the School of Dental Medicine were always provided with the most current information about each applicant prior to the time of the committee meetings for preview and evaluation. In cases where there were significant changes in the status of any applicant, or applicants were to be considered who were not on the agenda when the information was sent out for the forthcoming meeting, the appropriate reports were run off the morning of the day of the scheduled meeting and were then available in time for the committee meeting.

The availability of this information to each member of the Admissions Committee prior to the time of the committee meetings enabled the committee to function smoothly in an informed manner which tended to make each meeting highly productive and economical from the viewpoint of expenditure of time.

CAI at Kentucky

The University of Kentucky College of Dentistry is famous for innovative methods. For example, several courses are taught by computer.

Computer-Assisted Instruction (CAI) is used in endodontics, dental practice management, oral pathology, anatomical landmarks, and anesthesiology.

There are three display terminals consisting of typewriters and television screens. A slide projector is nearby for visual aids.

The student works at his own pace. At any time, help is available. The instructor may review the students' progress to aid in tutoring.

CYBERDENT will attempt to report on this project in greater detail in a future issue.

AFDE (from p. 1)

William Fitzgerald, School of Dentistry, University of Michigan. Associate Editor for Operations Research is Dr. Mortimer Shakun, School of Dental Medicine, State University of New York at Stony Brook. Other editors may be appointed in the future. All material should be submitted to Dr. Crandell.

The publication is produced by keypunching the information into tab cards for processing by a computer, using FORMAT, a text processing program. FORMAT produces reproducible copy directly on the system printer. The copy is right-justified without hyphenation. An alphabetic list of words used is produced which simplifies proofing. The copy is printed by multilith.

The Newsletter will be distributed free to one or more persons at each dental school in the United States and Canada, and other individuals and organizations known to have an interest in this field.

Computer Used In History - Taking

Computers are being used to take medical histories at dental and medical facilities. Patients and doctors are reportedly impressed by the speed and comprehensiveness of the method.

The computer provides a summarized printout that goes to the doctor and becomes a part of the patient's record.

The computer can also be programmed to concentrate on particular problems as the history develops.

There are several approaches being used, varying according to sophistication, financial support, and available equipment.

The patient sits at the computer console in some systems, answering questions as they flash on a screen.

In other installations, several computer terminals and a small computer are connected and dedicated to the history-taking function. Terminals designed for this particular prupose are avialable.

At the School of Dentistry, University of North Carolina, a pilot system is under development in which the patient is given a deck of tab cards with health questions printed on them. After the cards are separated into "Yes" and "No" piles, a computer program processes the cards and prints the medical history.

It appears that about 1500 questions with multiple answers and sophisticated branching will be sufficient to obtain as comprehensive a history as a physician could get in two hours of interviewing. Cost-effectiveness appears to be a feasible goal.

A survey of facilities utilizing such programs is being developed and will appear in a future edition of CYBERDENT.

CAIDENT (from p. 1)

"we are now designing a guidance, or management, system so that both faculty and students can monitor each student's learning progress." The basic problems caused by allowing each student to proceed at his own pace are resource allocation and scheduling difficulties. This is principally an administrative task, and because of its complexity, current plans call for computerizing the system. Students will indicate their progress in the curriculum, and administrators will enter resources and constraints, so that peak loads will be anticipated and hopefully accommodated. According to Fitzgerald, "the system will be designed and tested to handle about 30 students initially, but we plan to expand it so that five years from now we can track up to 600 students simultaneously. Clearly, we need real-time capability that can be provided only by a computer."

In addition to using the computer for teaching and guidance, students will be able to diagnostically test their progress by calling up various programs to assess their learning. Each program will contain diagnostic information about the student's progress and will suggest how he can improve in areas of weakness. "The students are very excited about this because it provides them with a private, non-threatening environment in which to demonstrate what they have learned, make mistakes without embarrassment, and get suggestions on how they can use their re-study time efficiently," Fitzgerald said.

The 72-73 school year is the start-up period for the project, and it will be in full production beginning in the fall of 1973. Fifteen students who arrive in the fall of 1974 will begin using the materials. Depending on continued federal support, plans call for 30 computer terminals by 1976.

FILLER

Retention is said to be improved by immediate feedback, which has been proven by research.

Practice Site Selection

(reprinted from Dental Student News, vol. 2, no. 5, p. 7, February 1973.)

Determining where to practice is the first and probably the most critical business decision faced by every new dental school graduate. Often this important determination is influenced by family, friends or associates whose outlook is not necessarily consistent with the long-term interests of the young dentist.

This year at the University of the Pacific School of Dentistry a computer helped graduating seniors make this decision more scientifically.

The school participated in an exercise, "Locating a Dental Practice," conducted by the Education Development Branch of the U.S. Public Health Service's Dental Health Center, San Francisco. Characteristics of the 58 counties of California were programmed into a computer at Stanford University.

The exercise covered 22 factors relating to choice of a practice location. Nine of the factors were economic, such as "Number of persons per dentist" and "Projected growth of populations 1970-1975." The other 13 factors-such as "Geographic region in California," "level of felony crime reports per 100 population," and "Intensity of air pollution"-dealt with life style.

The 15 fourth-year students who took advantage of the exercise indicated in advance their location preference. For four of them the county selected by the computer as the one most satisfying the student's requirements turned out to be the same county he had originally preferred. And for six students the preferred county appeared among the computer's top five choices. But the computer disagreed with the original location selected by five other students and suggested five different counties for each of them.

Of those who have zeroed in on a place to practice thus far, four plan to locate in counties recommended by the computer. However, family and friends apparently still are the major consideration of four others: they will ignore the computer's "top five" advice and hang out their shingles in the areas in which they were raised.

Computer Diagnosis

A medical group in Philadelphia (JAMA 223: 269-275, Jan 15, 1973) is using computers in the diagnosis of various conditions of acidosis and alkalosis, including a summary of blood chemistry values, the most probable diagnosis, differential diagnosis, and a discussion of the disturbances considered.

CYBERMEETINGS (from p. 2)

Association for the Development of Computer-based Instructional Systems (ADCIS), August 7-9, 1973, Ann Arbor, Michigan. Contact: William F. Fitzgerald, B310 New Dental Bldg., Loading Dock off Washtenaw Avenue, Ann Arbor, Michigan 48104.

ACM 1973 Annual Conference, August 27-29, 1973, Atlanta, Georgia. Contact: I. E. Perlin, Georgia Institute of Technology, 255 North Avenue, NW, Atlanta, GA 30332.

VIII International Symposium on Mathematical Programming, August 27-31, 1973, Stanford, CA. Contact: Richard W. Cottle, Department of Operations Research, Stanford University, Stanford CA 94305.

Operations Research Society of America, November 12-14, 1973, San Diego, California.

1974 Winter Simulation Conference, January 1974, New York City. Contact: Earnest Koenigsberg, School of Business Administration, University of California, Berkeley, CA 94720.

March 31, 1973

Dear Subscribers:

In order for CYBERDENT to be a viable publication, it needs sources of information. That's where you come in. You're invited to send clippings, reprints, cartoons, references, and letters to the editor.

To establish a data base of users of computers in dental education, please complete the questionnaire below and mail it to me.

C. E. Crandell, D.D. .
Editor

QUESTIONNAIRE

1. My use of computers is: ____ frequent ____ seldom ____ never (go to 7)
1 2 3

2. My experience with computers is: ____ more than three years
1
____ less than three years
2
____ just thinking about it
3

3. My use of computers has been for: ____ administrative work
1
____ clinical work
2
____ research work
4

4. My relation to computers has been as: ____ an administrator
1
(check all that apply) ____ a programmer
2
____ a user
4

5. I have computer programs that I am able to share with others: ____ yes ____ no
1 2

6. I have manuals and documentation on computer systems that I can share with others:
____ yes ____ no
1 2

7. I have information that should be shared with readers of CYBERDENT:

____ no; ____ clippings; ____ feature articles; ____ references
0 1 2 4
(check all that apply)

8. These are my comments on the first issue: (limit to 60 characters per comment)

____
1
____
1

9. These are my suggestions for future issues: (limit 60 characters)

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The Newsletter of
Data Processing in
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EXPANDED DENTAL PRACTICE MANAGEMENT: ECONOMICS AND SCHEDULING - PROGRESS REPORT 1

By Arnold Reisman, Professor of Operations Research, Case Western

Efficient management of a dental practice involves many complex and interacting factors. The problem is growing increasingly complex as size of practice increases (as in Health Maintenance Organizations), with increasing demand. Also, the diversity as well as the number of workers is becoming greater, notably due to the recent introduction of a new category of allied professional, the Expanded Duty Dental Auxilliary (EDDA).

Primary decisions involve the configuration of the practice; that is, the number of workers in each category: dentist, EDDA, hygienist, etc. To assist the dentist-manager establish the best practice configuration, as well as to investigate different scheduling rules and other management procedures, a methodology involving a computer simulation has been developed to compare different options in terms of economic and other criteria.

Several scheduling rules (e.g.,

(see EXPANDED DUTIES, p. 5)

ORTHODONTIC PROGNOSIS BY COMPUTER MAY PROVIDE 'INSTANT EXPERIENCE'

(reprinted from Dental Survey, May 1973, with permission)

Computer-assisted orthodontics soon may permit students and practitioners to observe, in a matter of minutes, accurately projected growth patterns in normal and abnormal cases - rather than wait for the same events to unfold in dental practice.

The new combination of dental science and computer technology is a result of research by Dr. Geoffrey F. Walker, whose work at the University of Michigan Dental School is supported by the National Institute of Dental Research.

At the heart of the project are some 15,000 skull profile radiographs, taken over a period of years. Dr. Walker and his research team have developed a combination of statistics, mathematical models and electronics to convert these radiographs to x-y coordinate maps of the skull and jaws. These models or maps are automatically converted to punch cards or transferred directly via telephone lines into the memory bank of a large computer.

(see ORTHODONTIC DIAGNOSIS, p. 5)

cyberdent

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School of Dentistry
University of North Carolina
Chapel Hill, North Carolina

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Submit material for publication to the Associate Editor indicated or the Editor. For matters pertaining to circulation, write to Miss Karen Scarlett, UNC School of Dentistry, Chapel Hill, North Carolina 27514.

BOSTON MDs USE COMPUTERS FOR MANAGEMENT OF HEART-LUNG CASES

A medical group in Boston (JAMA 223: 308-312, Jan 15, 1973) has a computer program which gives management guidelines in the care of patients suffering from acute respiratory failure, acute breathing problems, and chronic heart-lung disorders.

Of those using the program 68% said the program was valuable in establishing diagnosis and determining treatment; 26% said it had educational value; only 6% said it was a waste of time.

DP Comes of Age?

Editorial

In June, the first National Computer Conference was held in New York. For five days and nights, the computer people displayed their wares. The presentations varied - from poor to excellent - from second generation to fourth - from esoteric to mundane. There was something for almost everybody. And for many, there wasn't enough time to see and hear all that was attractive.

An overall view of the Conference suggests that the Data Processing industry has come of age. Although there were many papers devoted to futuristic use (or abuse) of computers where the practical applications were not readily obvious, there appeared to be a definite shift in emphasis to the here and now. Likewise, the attitudes of management appear to be toward cost-effectiveness for data processing functions the same as other operations. In personnel considerations, the same type of trend is evident; programmers not only can write code, they must - and on schedule.

The glamour isn't completely gone, but it is somewhat dimmer. Instead, brighter prospects exist for applying available technology to applications that are integrated and realistic. The publishing industry is a case in point; an entire session at the Conference was devoted to substantial computer-based changes in text entry, text editing, printing, and distribution. The record-keeping of the health industry is a prime candidate for this kind of evolution.

These are the indications of maturity that were observed at the Conference. Data processing has come of age. And that is good.

KENTUCKY CLINICAL SYSTEM

By Richard C. Bartlett

The University of Kentucky College of Dentistry accepted its first class in the fall of 1962. The Kentucky curriculum deviates from the traditional pattern in the distribution of the basic and clinical sciences. While the first two years concentrate primarily on the basic sciences, some time is freed during this early period to enable students to see patients in a clinical environment. The student is taught techniques of interviewing and taking a history as well as principles of patient education and patient management. Third and fourth year students treat patients comprehensively. Each student plans and executes complete dental treatment for all of the patients assigned to him.

HOW THE SYSTEM WORKS

Patients are screened and assigned to students by the Director of Clinics, who informs the student. The student contacts the patient and arranges appointments.

At the first appointment, under the supervision of an instructor of the Department of Oral Diagnosis and Oral Medicine, the student takes a history, does a soft tissue examination, radiographs, and diagnostic casts.

Before the next appointment, the student correlates and interprets his findings, establishes a diagnosis and utlines treatment. When the patient eturns, the instructor of Oral iagnosis examines the patient and pproves or modifies the student's reatment plan. When the treatment lan has been approved, the Clinic usiness Office enters coded nformation in the Treatment and ayment Plan form and prepares a olor coded department data card for ach item of the treatment plan. his packet of color coded cards is placed in the "pocket" of the patient chart. When the student completes a particular treatment item, he turns in the appropriate color coded card. Each time a patient is seen, the student completes a Daily Clinic Data card which reports his activity for that clinic session. In recording information on this card, the student refers to the color coded data card or to the Treatment and Payment Plan form for the appropriate information.

SCREENING OF PATIENTS

At the screening examination, a tentative treatment plan is formulated by the Director of Clinics. The patient's needs are recorded on the screening card in broad categories (e. g., extractions, endodontics, amalgams, periodontics, etc.). The total number of procedures in each category is coded to indicate whether the patient will require "few" or "many" procedures. The data on these cards provide the basis for the computer print-out called the "screening file", which is a list of patients who have been screened and are available for assignment. There is a breakdown of the total list into classified groups requiring particular types of treatment. The patient's name is followed by the treatment procedures anticipated; if a patient requires different types of treatment, his name and the entire tentative treatment plan will be recorded in each section. Initial assignments include one child patient and three to four adult patients whose cumulative dental needs include restorative dentistry, periodontics, and prosthodontics. Subsequent assignments become increasingly more difficult and require more selectivity; therefore, the classified sections of the screening file become particularly useful.

Screening information is withheld

(see KENTUCKY, page 4)

(more on KENTUCKY, from p. 3)

from the student to avoid influencing his judgement in planning treatment.

When a patient is assigned, the patient's name is deleted from the "screening file" and is added to the second file, the "patient progress record". This file contains an alphabetized list of students with the names of all patients assigned to each student. The entry under each patient's name reveals the history of the patient's progress in the clinic from the time of initial contact to his current status; space is provided for recording of additional data through completion of treatment. The computer prints the student's plan for comprehensive dental treatment of the patient. Entered alongside each treatment procedure is the name of the department responsible for supervising the student's work during that aspect of treatment, and the tooth for which the procedure is to be performed; space is provided for entry of date of completion for each treatment procedure.

Printed at the end of the treatment plan is the total number of items, the number of procedures completed and number of procedures still to be performed. If a patient has been dismissed from the program, this information is shown and the reason for dismissal.

The system of computer data processing is an integral component of the comprehensive patient care program. Without it, the administrative problems involved in coordinating the needs of large numbers of students and patients would be considerably more time-consuming and therefore less manageable. By furnishing vital information rapidly and efficiently, the computer has helped to expedite in practice the comprehensive care program which the planners of the University of Kentucky curriculum considered essential.

HARDWARE

The entire system is executed in a batch mode on the computer located in the University of Kentucky Computing Center on the main campus. At present the equipment consists of an IBM System 360, Model 65 with two 2314 disk units, one 2401 seven-track tape drive, four 2401 nine-track tape drives, a 1000-card-per-minute reader, a 300-card-per-minute punch, and two 1100-line-per-minute 140 printers.

VOLUME OF DATA PROCESSING

Data batches and report-generating programs are run on an as-required basis. Approximately 27 hours of computer time were used during 1971. This included all the computer time required for program development and debugging. Approximately 50,000 cards were keypunched and keyverified to provide the input for all the programs.

SOFTWARE

All programs are written in FORTRAN IV and run under the 360 Operating System (OS-MVT) in conjunction with a modified version of the Houston Automatic Spooling Priority System (HASP). The 360 Utility Sort and Merge is also used extensively.

DEVELOPMENT

The first stage of the clinic management system to be developed was the data acquisition and computer programming required to produce at regular intervals a summarization of all work done by each student in the dental clinics. Each department designated a number of discrete procedures which were then subdivided into any number of small work divisions called steps. After each clinic period, the student reports on 5 x 8-inch preprinted data cards the procedures he has performed that day. These data are keypunched and information on the punched cards is then transferred to magnetic disk. It can be retrieved, arranged in suitable order and printed at any time for departmental reports.

REPORTS

Presently the system is capable of generating 19 different reports for faculty and administrative use in evaluating student and patient progress.

more on EXPANDED DUTIES

(continued from page 1)

scheduling the patients at the first available time, scheduling patients requiring similar treatments in the same time block, etc.) Have been simulated, and are discussed. In addition, a novel concept of scheduling is developed. This is based on the concept of scheduling treatments rather than patients. From the scheduling viewpoint a large number of medically different treatments turn out to be equivalent, in the sense that they require roughly the same amounts of time from the same workers in the same sequence. With a small number of classes of procedures to handle, prescheduled charts may be generated for different practice configurations and anticipated demand for service. These can produce highly efficient schedules by matching the work simultaneously going on in different operatories so as to make efficient use of constraining personnel, especially dentists. Several such charts are presented, and preliminary test runs are highly encouraging.

The economic and other implications of a wide variety of practice configurations have been investigated, as functions of the number and mix of patients anticipated. Several computer printouts are presented to demonstrate the range of results that are available. For given input data (configuration, patient population, fee and salary structure and other costs), the simulation can compute average worker utilization, patient waiting times, net earnings, etc., and can show interrelations between pairs of variables graphically.

Moreover, the paper presents a step-by-step procedure, in the spirit of IRS 1040 forms, for the purpose of hand-calculating the economics of various practice configurations. These forms were developed so that people who are not knowledgeable in the formal methods of financial and/or accounting analysis can, so to speak, "do it themselves."

more on ORTHODONTIC DIAGNOSIS

(continued from page 1)

After the skull outline maps are fed into the computer, they can be reproduced at any time for evaluation in comparison with other skulls. If an orthodontist wants to know how a patient will change in the next several years, a special computer program will project the most probable natural growth without any changes due to treatment. The orthodontist then determines a treatment plan and enters into the console the orthodontic forces needed to carry out the plan. The computer applies this information to the patient's computer model and calculates all changes that would occur. If the results are unsatisfactory, the orthodontist may program new treatment forces, and a new plan is run. Using the system, a researcher or clinician can extract thousands of measurements and growth changes with speed and accuracy. Since several varying treatments can be tested in a very short time, the clinician, or student, can simulate years of growth supervision and months of treatment in a few minutes with a very high probability of success - and all without touching the patient.

With a single skull radiograph, Dr. Walker can project typical skull maturation patterns with an approximate 70% possibility of successful matching. Given two more radiographs, spaced at least six months apart, the probability of success rises by a considerable margin.

Students stand to benefit immensely from the system. "Where the average orthodontic practitioner may only see a dozen of certain jaw abnormalities in 20 years of practice," says Dr. Walker, "the data banks will have hundreds on file from which the student can learn."

Using this system, he estimates that the University of Michigan will be able to graduate an orthodontist in one or two years of graduate work who is better qualified in terms of experiences than some dentists who are near retirement.

MORE HANDS-ON CARE SOUGHT

(from American Medical News, April 23, 1973)

The average practicing physician spends only 50% of his time in "hands-on" medicine.

Whether he is in solo practice, a small partnership, or a larger group, he has medical records to fill out, telephone calls to make and answer, patient histories to record and review, personnel policies to implement and direct, and ever-increasing paperwork.

Accordingly, the AMA's National Congress on the Socio-Economics of Health Care, usually an academic discussion of such abstract issues as national health insurance, focused on a problem much closer to home for most MDs: practical how-to ways of increasing medical practice productivity.

The conference convened practice management experts in Chicago April 13-14 to advise MDs on how to find time to provide more patient care.

W. B. Hildebrand, MD, chairman of the sponsoring AMA Council on Medical Service, noted that increased productivity can help improve quality, control costs, and alleviate some areas of the physician shortage.

COMPUTER APPLICATIONS: Major roles were forecast for the computer in patient billing and patient histories. Kenneth G. Robinson, president of Computer Servicenters, Inc, Birmingham, Ala., said computerized billing will provide both office organization and a data base for management decisions. He pointed out that many physicians have increased collections to as high as 98% at an average cost of only 2% of fees charged. Robert Reid, MD, and Richard Snapp, MD, of Medi-Tech, Inc., Indianapolis, said that although not yet in wide use, computerized patient histories are

(see HANDS-ON, p. 7)

NEED INFORMATION FOR RESEARCH?

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The National Technical Informatio Service is a central source for th public sale of Government-sponsore research reports and other analyse prepared by Federal agencies, thei contractors or grantees. It fill 5,000 new orders a day and it is on of the world's leading processors o specialty information, supplying th public with more than two-and-a-hal million documents and microfilm annually. The NTIS informatio collection exceeds 680,000 title with more than 100,000 documents i current stock. All are available fo sale and a wide interest bulletin an best seller lists emphasize thos most in demand.

The agency is directed by statute t recover its costs and has becom largely self sustaining with les than 20% of its financing from direc appropriations.

Timely and continuous reporting t subscribers is ensured by continuin agreements between NTIS and hundred of Federal research-sponsorin organizations. In addition, NTIS i the marketing coordinator for variou Information Analysis Centers in th U. S., for their publications an technical inquiries.

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The foregoing and many more product and services are described in detail

(see NTIS INFO. SERVICES, p. 8)

EXPERIMENTAL DENTAL RECORDS SYSTEM
(from J Dent Res 52:568-569, 1973)

By D. R. Hunt, Univ. of Adelaide

Facilities for the storage and retrieval of dental treatment records. Analysis of a conventional hospital system showed that 12 record events could be distinguished: registration, admission, assignment, history, examination, radiographic examination, laboratory examination, consultation, diagnosis and treatment plan, treatment, review, and discharge. Individual records could be divided into episodes delineated by admission and discharge events. Records of 11 patients were analyzed in the experiment and selected information was coded on punched cards for computer entry in a program that generated a magnetic tape master file that stored the data in logical sequence. A second program written for punched card input and print output enabled simulation of an on-line teletypewriter keyboard and visual display unit communication with the computer. Responses to requests for five types of information could be elicited. The experiment showed that computer storage of dental records and retrieval of information about the treatment management of individual patients was possible. However, before a computer-based system can be specified and developed for implementation in a real situation, here is need for considerable urther study of the use of dental ecords and the computer methods that ould be used. Advice from systems nalysts and computer experts would e essential.

A PRACTITIONER ASKS A QUESTION
"What about helping me?"

(from Computerworld 9/20/72)

W. A. Riggert, a practicing dentist in Berkley, Michigan, has called for help from both the dental profession and the data processing industry to level the paperwork associated with private practice. In an article written for Computerworld (September 20, 1972), Riggert says, "a large number of professional offices are presently utilizing the peg-board type of accounting and information gathering system. Although there is a large number of 'automated systems', they essentially do nothing more than rely on pegboard information gathered manually to produce billings and a limited number of accounting reports - 'automatically'."

He goes on to deplore other efforts made thus far, such as placing time-sharing terminals in practitioners' offices. Processing the data is not the problem, according to Riggert, but the collection of it.

A significant factor pointed out by Riggert is the deteriorating turnaround in the processing of third-party payments, which has resulted in a float of millions of dollars in accounts receivable.

The article also cites the difficulty of transferring health care data between offices. This of course multiplies the collection problem.

Riggert throws the challenge to both professions. While he offers no solutions, he deserves credit for recognizing and documenting the problem.

(more on HANDS-ON, from p. 6)

apable of printouts that both ighlight clinical problem areas and ncorporate considerable subtlety of xpression. And Frederick V. Light,), an Ohio private practitioner, aid he is so pleased with a omputerized recordtaking system nstalled for him by Medical Data ystems Corp., Brook Park, Ohio, that he only disadvantage is that if the system were to be removed, he and his staff would all quit because they are so spoiled. Dr. Light said that his original misgiving about the "mysteries" of the computer soon gave way to a renewed interest in practicing medicine and a much more enthusiastic attitude. He even brought along his office manager to confirm her wholehearted approval.

Computers and Medicine

Another new publication in the computer field is available to CYBERDENT readers. Computers and Medicine is a four-page newsletter published bi-monthly by the American Medical Association and sponsored by the Board of Trustees Committee on Computer Systems in Medicine.

In addition to regular news items, it also contains Comments (from readers), Developmental and Experimental items, and a Resource Corner which reports on new books, meetings, and training programs.

Subscriptions are available for $5.00 per year from Subscription Services, American Medical Association, 535 North Dearborn Street, Chicago, Illinois 60610. Computers and Medicine is now in its second year of publication.

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more on NTIS INFORMATION SERVICES
(continued from page 6)

in the NTIS Information Services Booklet, free on request. Ask for NTIS-PR-73-00.

New--This Year

NTISearch users now have access to the Smithsonian Science Information Exchange's (SSIE) current research information file.

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REFERENCES

Cyber-References is a new feature this mont
The references are provided by the Heal
Sciences Library of the University of Nor
Carolina.

Readers are invited to submit references f
publication. In addition, another featur
CYBER-ABSTRACTS, is planned for future issue
Contributions are invited.

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Cyber-Meetings

Meetings of interest to dental educators who are working with computers.

Association for the Development of Computer-based Instructional Systems (ADCIS), August 7-9, 1973, Ann Arbor, Michigan. Contact: William F. Fitzgerald, B310 New Dental Bldg., Loading Dock off Washtenaw Avenue, Ann Arbor, Michigan 48104.

ACM 1973 Annual Conference, August 27-29, 1973, Atlanta, Georgia. Contact: I. E. Perlin, Georgia Institute of Technology, 255 North Avenue, NW, Atlanta, GA 30332.

VIII International Symposium on Mathematical Programming, August 27-31, 1973, Stanford, CA. Contact: Richard W. Cottle, Department of Operations Research, Stanford University, Stanford CA 94305.

Operations Research Society of America, November 12-14, 1973, San Diego, California.

1974 Winter Simulation Conference, January 1974, New York City. Contact: Earnest Koenigsberg, School of Business Administration, University of California, Berkeley, CA 94720.

1974 National Computer Conference and Exposition, May 6-10, 1974, Chicago, Illinois. Contact: AFIPS, 210 Summit Avenue, Montvale, NJ 07645

EUROCOMP, the First European Computing Congress, May 13-17, 1974, Middlesex, England. Contact: Online, Brunel University, Uxbridge, Middlesex, England.

MEDINFO 74, the First IFIP World Conference on Medical Informatics, August 5-10, 1974, Stockholm, Sweden. Contact: Medinfo 74, Box 1230, S-17124 Solna 1, Sweden.

UNIVERSITY OF MICHIGAN SCHOOL OF DENTISTRY TO HOST COMPUTER CONFERENCE

It was announced today that the School of Dentistry at the University of Michigan will host the Summer Conference of the Association for the Development of Computer-based Instructional Systems. The Association, known as ADCIS (pron. "add kiss") by its members, is the international organization of educators who are involved in a revolutionary new technology known as Computer Assisted Instruction. Computer teaching has already had a profound effect on education at all levels and twice a year ADCIS members convene to share ideas, present papers, and to hear about the latest developments.

The Conference is being hosted by William F. Fitzgerald, Ph.D., Director of the CAIDENT (rhymes with "trident") Project at Michigan's Dental School, who is also General Program Chairman of ADCIS. According to Dr. Fitzgerald, the Conference will emphasize Justification of Computer-Assisted and Computer-Managed Instruction. Highlights will include:

--Demonstrations of computer terminals and computer programs that teach

--An address by Jesse E. Laskin, Assistant to the General Counsel of the National Science Foundation, on the topic of NSF's interpretation of the "public domain" status of computer teaching programs

--a panel on computer education in elementary, secondary, vocational and two-year colleges moderated by Jimmer Leonard

--Presentations by

*Donald Bitzer of the University of Illinois on the PLATO IV System

*Victor Bunderson of Brigham Young University on the TICCIT Project

*Harvey Long of IBM on his company's position on supporting computer learning

*Andrew Molnar, Chief of Instructional Materials and Practices Branch, Division of Higher Education and Research, Department of Health, Education and Welfare on technological innovations in education

*R. E. Hallman of IBM on their successful large-scale internal industrial training using computers as teachers

The meeting will also include meetings of Special Interest Groups within the Association; the Health Sciences Interest Group is the largest of these groups which is one reason why Michigan's Dental School is host.

According to Dr. Ronald Christopher, Coordinator of Computer Assisted Instruction at Ohio State University and President of ADCIS, the Association includes representatives of over 100 military, industrial, governmental and educational institutions from throughout the world. "This meeting is designed to be of great interest to every member and to all agencies involved in computer assisted instruction," Dr. Christopher said. "Every project in which computers are used to teach is concerned with the question of justification, and this meeting is planned to address that question directly," he added.

The meeting will be held on August 7-9 in Ann Arbor. Inquiries about the meeting should be addressed to: Dr. Peter Dean, ADCIS Secretary-Treasurer, P.O. Box 1403, Los Gatos, California 95030.

For Further Information Contact: William F. Fitzgerald, Ph.D., Director, CAIDENT Project, School of Dentistry, University of Michigan, Ann Arbor, Michigan 48104, (313) 763-3337.

READERS' DATA BASE

The last page of the first issue of CYBERDENT was a questionnaire in which readers were asked to identify experience and use of computers. They were also asked to identify items they might contribute for publication or sharing with others. Lastly, comments and suggestions were requested.

The response was 35 of 380, not very good. The results are shown below.

RESULTS OF CYBERDENT QUESTIONNAIRE

1. My use of computers is: 24 frequent 7 seldom 3 never
2. My experience with computers is:
   - 26 more than three years
   - 4 less than three years
   - 1 just thinking about it
3. My use of computers has been for:
   - 22 administrative work
   - 15 clinical work
   - 21 research work
   - 1 teaching
4. My relation to computers has been as: (check all that apply)
   - 17 an administrator
   - 13 a programmer
   - 25 a user
5. I have computer programs that I am able to share with others: 15 yes 14 no
6. I have manuals and documentation on computer systems that I can share with others: 8 yes 21 no
7. I have information that should be shared with readers of CYBERDENT: (check all that apply)
   18 no; 3 clippings; 16 feature articles; 3 references

Comments ranged from "good," "great idea," excellent," and "useful" to "its a beginning," "difficult to read because of continuing articles on back pages," and "I don't think this is for me."

Suggestions included "emphasize computer use in schools and practice," "review CAI activities at all schools," "list person to contact on articles," "increase descriptions of working programs," "report more research," "discuss problems," "software compatibility," and "include hardware and software descriptions in each article."

The editors will respond to these results.

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PAIN DIAGNOSIS

Automated Diagnosis and Treatment Planning for Craniofacial Pain

(by Kerry E. Kilpatrick and Michael S. Leonard, Health Systems Research Division, University of Florida)

Mathematical models have been ieveloped to diagnose and plan treatments for craniofacial-pain patients. These models provide an automated means of duplicating the iiagnosis and treatment plans of iental experts. Moreover, the models permit an examination of the critical considerations associated with both iecision-making processes.

In conjunction with the university's ollege of Dentistry, the Health Systems Research Division at the Jniversity of Florida has spent two ears developing models for the care of the temporomandibular-joint type of craniofacial pain. Dr. Thomas ast and Dr. Parker Mahan from the ollege of Dentistry have processed nd categorized patient data from the niversities of California at Los ngeles, Florida, Illinois, and

see PAIN DIAGNOSIS
(continued on p. 4)

READING X-RAYS

NEW MACHINE 'SPEED READS' 1500 RADIOGRAPHS PER HOUR

(From ADA News, vol. 4, p. 1, May 21, 1973.)

Philadelphia-A former public health department dentist has programmed a machine to "read" radiographs.

Mark Shapiro's Computerized Mass Screening for Dental Decay system, which can interpret about 1,500 radiographs an hour, was developed as part of his work toward a PhD in biomedical engineering at Drexel University here.

"It isn't the sort of thing you'll see in a dentist's office," he said. "Its major benefit is in public health work where large populations have to be screened."

The system requires only a dental auxiliary who can take radiographs of each patient's mouth.

On the X-ray film, decayed, filled,

see READING X-RAYS
(continued on p. 7)

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Newsletter of Data Processing in Dental Education
School of Dentistry
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Submit material for publication to the Associate Editor indicated or the Editor. For matters pertaining to circulation, write to Miss Karen Scarlett, UNC School of Dentistry, Chapel Hill, North Carolina 27514.

COMPUTER GOOFS!!!!

IRS MAKES $33,037,687.07 ERROR

a California man recently received a bill from the Internal Revenue Service for back taxes. He was given a few days to come up with $33,037,817.07. This included a late payment penalty of $164,000 and interest charges of $59,000. The man said he knew he owed the federal government some money, but thought it was around $130. The IRS blamed the mixup on a computer error.

EDITORIAL

The Problem-Oriented Record

Many readers of CYBERDENT have undoubtedly attempted a series of case studies or epidemiological reviews of patient records. It is possible to become discouraged very quickly in such an endeavor, particularly if the study is initiated after the fact - say when an interesting case is seen and one suspects that the editor of a target journal isn't keen on publishing a series of one case, so one attempts to find similar cases in clinical records or the literature. The literature is indexed so that side of the problem is somewhat simpler. Clinical records are usually indexed also - by patient name or by an arbitrarily-assigned number or by social security number - none of which are of much value in finding the desired cases.

So the clinician shares his problem with his colleagues who may be able to remember a name or two, but eventually he arrives at the record room or chart room, and confronts the record clerks who confirm his suspicion that there is "no way" to locate patient records except by name or number. The alternative next available is to select at random a certain number of records and review them; perhaps, he thinks, this will overcome the fallacy of the "memory-dependent" system of records. But no, this introduces other problems, perhaps greater in concept and certainly greater in scope than the first.

Dr. X's writing is impossible to read; Dr. Y's jargon or abbreviations are foreign; Dr. Z's entry into the chart somehow never got there at all; Dr. Q's tooth-numbering scheme is different; ad

(see EDITORIAL, page 8)

ANALYSIS OF CLINICAL INCIDENTS

COMPUTER CONTENT ANALYSIS OF CLINICAL CRITICAL INCIDENTS

(From a paper by Richard S. Mackenzie and Kerry E. Kilpatrick, University of Florida)

The purpose of this research was to compare computer and human processing of short written essays as to costs, reliability and validity. The findings have implications for computer grading of essay examinations in which the grader uses a check list of content that should be covered in the essay. In this study the written materials analyzed by computers were critical incidents of dental services rendered patients, along with the supporting biological knowledge used by dental students in rendering that service. The data were collected over a seven year period from 24 different schools of dentistry with about 4,000 dental students responding.

The student was asked to think of a patient to whom biological knowledge made a difference in the service rendered, in a way that contributed to the health or well being of the patient. After reading the general format, the student was given questions to answer in his own words.

To initiate the written material, the student was asked to write specific details about the situation, his own work or actions in delivering the service, how the service helped the health of the patient, and what the biological knowledge was that was correlated with or supported the service.

The 14,000 handwritten incidents were input to an IBM computer and a series of programs called the Inquirer II System was used. Each time the computer processed a word, it checked a dictionary and classified the incident by type of service rendered and category of biological knowledge used.

For example, if the student wrote "periodontal disease is influenced by diabetes", the computer would classify the information into the subclass: "Systemic condition affects oral condition". This sub-category falls under the more general class, called "Pathology". The computer classified biological information into 57 sub-classes all of which were categorized into one of the seven basic biological sciences.

At the same time, the computer classified on dental services. If the student said "I will insert an amalgam" or "I could have inserted an amalgam", the computer exits. If the student said, "I inserted an amalgam", the computer would classify the information as Restorative Dentistry which in turn would be classified as Treatment. All 33 sub-categories of actions were placed into one of 4 major services: Prevention, Diagnosis, Treatment, or Behavioral Management of Patient. One of the major clinical uses of biological knowledge is in saying something to the patient in a way that will somehow promote the patient's health.

A clerk edited the handwritten material for clarity and spelling, punched the students' own words onto IBM cards, and then proofread and corrected any errors in card punching at an average rate of one incident each 4.3 minutes. A human coder took 2.2 minutes to read and classify an incident, about half as long. However, a subject matter expert earns four times as much as a clerk-card puncher.

It costs about $14.00 per 100 incidents for the computer to analyze and tabulate the results; to compare favorably with this cost, the human coder would have to earn less than $1.75 per hour. For little additional cost, the computer has the

(continued on next page)

advantage of being able to do intricate analyses and tabulations which would be infeasible for humans, such as the number of times that "inflammation" was mentioned as related to types of restorative materials.

Reliability was determined by the percentage of agreement between classifications on two separate occasions. When classifying information into 90 subcategories, coder 1 (the subject matter specialist) agreed with himself 77% of the time, 47% of the time with coder 2, and 64% with the computer. Coder 2 (a graduate student) agreed 75% with himself and 38% with the computer; the computer agreed with itself 98% of the time. The 2% error for the computer was due to the card puncher, who edited and punched the data on two occasions separated in time by one year. As can be seen, the computer takes the subjectivity out of grading essays.

To establish validity, each of the 100 incidents were discussed at length by the two coders and the resulting content analysis divided into categories served as a criterion against which to compare the accuracy of the human coders and the computer.

A change in % agreement occurs in humans with the passage of time and is one of the problems with using human coders in longitudinal content analysis research.

This system is probably not economically feasible for grading essay exams for a single class of students. The system would be more feasible if the state of the art had advanced to the point where the computer could read the student's handwriting directly. Also, the system would have additional merit if the same essay examination was given at different times over a span of years.

CONCLUSIONS

1. For analyzing written essays, the man-computer system is more reliable and hence more objective than a human coder.

2. Using the Inquirer II System, the computer is able to approach the human in validity or accuracy for content analysis.

3. The man-computer system utilized for simple analyses such as in this study, is more costly than human coders for content analyzing written essays.

more on PAIN DIAGNOSIS

(continued from page 1)

Indiana. These university-clinic records have been used in constructing and testing the diagnostic and treatment-planning models.

Patient diagnoses are generated by a linear pattern-recognition classifier trained with samples of preclassified craniofacial-pain patient data. A Markovian decision model of the treatment-planning process selects treatment regimens for craniofacial-pain patients. Background information on both models is available on request from the Health Systems Research Division.

Approximately 90% of the diagnostic model's classifications and 93% of the treatment-planning model's treatment selections concurred with the decisions made by experts in the field of craniofacial pain. Applications of the models in teaching, research, and private practice environments have been explored.

COMPUTER SCHEDULING OF PATIENTS

Educational Response of Students to the Algorithmic Assignment of Patients

(From a paper by Drs. Nelson S. Logan, Clemens A. Full, and Frederick M. Parkins, University of Iowa)

In recent years there has been interest in developing curricula which allow students to progress at individual rates. Flexible scheduling requires computers to control and manipulate a very complex matrix of simultaneous and concurrent events.

At the University of Iowa, College of Dentistry, a computer system has been developed for teaching clinical Pedodontics in which a computer program constructs, monitors, and optimizes the clinic assignments of patients and students according to faculty-defined algorithmic procedures:

1. Categorizing all possible clinic activities into a finite number of classifications for easier identification.

2. Identifying those clinical experiences that are most critical and essential (called essential experience items) which students must be able to perform, independently.

The Pedodontic Clinic involves six appointment periods per day, four days per week, six dental students and six chairside assistants. Students and patients are assigned selectively by a faculty defined scheduling algorithm to provide experience inversely related to demonstration of competence.

Each morning, appointments for the day and the students assigned to the clinic are "matched" by comparing the oral health needs of the patients (as described on the treatment plan for this appointment) with the educational needs of the students (as described by their EEI profile). In its simplest form, the scheduler takes a patient with an appointment and a treatment to be rendered, and assigns him to a student who has not completed this EEI. The patient will be assigned to the student with the fewest remaining EEI's if more than one student needs the experience.

In general, the scheduling algorithm is a program built to use the above principles in combination to determine the daily schedule for the clinic. The patient and student files are updated daily to reflect the treatment completed. These updated files are then, in turn, used in the construction of subsequent clinic schedules.

This assignment of patients to students can (1) substantively effect the efficient utilization of teaching material and (2) promote the educational progress of students, on an individualized basis. In the past, the receptionist attempted empirical scheduling, but the clerical burdens were such that shortcomings in assignments always occurred. The many parameters of scheduling, including the differences in the educational maturity of students and the differences in patient clinical needs, are best monitored, evaluated, and the effects interpreted with a computer system.

The most interesting and important aspect of the project has been observing the effects of the computer scheduling on the progress of students in the clinic. The students performance is expressed in terms of a percentage. If the student is performing at the 60% level, this means that the student has completed (independently) 60 percent of clinic

(see COMPUTER SCHEDULING, p. 6)

more on COMPUTER SCHEDULING
(continued from p. 5)

procedures attempted. The remaining 40% required (to some degree or other) the assistance of an instructor. Similarly, with each succeeding week the students' performance improved until at the end of time measured the student was performing at approximately the 90% level.

This profile can be interpreted in several ways, including whether the student has shown a steady increase in clinical growth rate. Some students require less experience than others to reach a comparable level of performance. Some students may complete the vast majority of the EEI's after just two units of time and are capable of leaving the Pedodontic clinic before the other students.

It is evident from this experimental program that the following conclusions are valid:

1. Students vary substantially in both the number of experiences needed to gain clinical competence and the length of time needed for its obtainment.

2. A scheduling algorithm can be developed to assign students and patients that will optimize the educational benefits for students by encouraging student concentration in the area of need.

Also, when a course is taught for a fixed length of time, the termination of the course finds the competence levels of students vary markedly. This would lead us to believe that courses should be conducted such that the quality of student performance is the determining factor for its ending and not the passage of an arbitrary length of time (such as the semester).

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CYBER-MEETINGS

Canadian Computer Show and Conference, October 16-18, 1973, Toronto, Canada. Contact: Robert Coleman, CIPS, 481 University Ave., Toronto 2, Canada.

First International Joint Conference on Pattern Recognition, October 30-November 1, 1973, Washington, D.C. Contact: Azriel Rosenfeld, Computer Science Center, University of Maryland, College Park, MD 20742.

IEEE 1973 Conference on Systems, Man, and Cybernetics, November 5-7, 1973, Boston, Massachusetts. Contact: Sheldon Baron, Bolt Beranek, and Newman, Inc., 50 Moulton St., Cambridge, MA 02138.

International Conference on Health Technology Systems, November 14-16, 1973, San Francisco, Calif. Contact: Morris F. Collen, Kaiser-Permanente Medical Care Program, 3779 Piedmont Ave., Oakland, CA 94611.

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INFO 74, September 9-12, 1974, New York, N.Y. Contact: Clapp & Poliak, Inc., Exposition Management, 245 Park Ave., New York, NY 10017.

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more CYBER-REFERENCES
(continued from page 6)

People prefer machines to doctors. New Sci. 58: 814, June 28, 1973.

New machine speed reads 1500 radiographs per hour. ADA News 4: 1, May 21, 1973.

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more on READING X-RAYS
(continued from page 1)

or missing teeth show up as varying patterns of light and dark when placed under a light force from Dr. Shapiro's machine.

The machine translates these patterns into information which is then fed into a computer. The computer then prints out a diagnosis from the individual radiographs or summarizes the data from an entire group.

"With this sort of information it is possible to plan the number of dentists you would need to treat a particular number of people," he said. "In epidemiological studies it can save hundreds of man hours."

EDITORIAL
(continued from page 2)

nauseum.

The plea here is not for standardization alone, although that would be a giant step forward. Nor is a machine-readable (ie., a computer or an electronic sorting device) record form or format urged, although it is suggested that this might be the direction to follow. What is needed is a 20th century approach to the keeping of dental (and medical) patient records.

Hardly anyone argues with the necessity of keeping records. Very few suggest that the job is being done well. Retrievability and usefulness of the information recorded is inadequate at best. What are the solutions?

A step in the right direction is the PROBLEM-ORIENTED RECORD that is gaining favor in medical schools (and some dental schools) and practitioners' offices. Popularly known as the POMR (for Problem-Oriented Medical Record), this record is comprehensive, concise, and logical; it simplifies review by the physician and his colleagues; it becomes a valuable educational tool. Further explanation of the system is inappropriate here; the reader is referred to books by L. L. Weed, and by J. C. Bjorn and H. D. Cross; also American Medical News Vol. 16, No. 7, February 19, 1973.

The POMR is not likely to be the complete answer to the retro-searcher of case histories, but it is a promising approach to part of the problem. It is also heartening to witness its increasing acceptance.

COMPUTER MATCHING

Patients desiring service in the clinics of the UNC School of Dentistry are first seen in the Screening Clinic. A dental chart is created which includes a collection of vital statistics and health information.

The Social Security Number is used as a patient identification number. Because conversion to this system is incomplete, some chart numbers begin with a digit from 1 to 9 followed by three or four zeroes; these are not genuine Social Security Numbers but this format is being used until the conversion is completed.

A Panorex film is made prior to a cursory clinical examination. Additional films may be made as required. For those patients whose dental needs and social restrictions are acceptable, a MATCHING DIAGNOSIS FORM is completed and forwarded to the Dental Data Center. This form serves as a source document from which coded data is keypunched and entered into the computer where the patient is matched with a student needing the same services. An appropriate faculty preceptor is also assigned to each patient and the student and the preceptor are notified of the assignment by computer printout through the school mail service.

The student schedules the patient in Information Gathering Clinic where he obtains a complete history, a thorough examination of soft and hard tissue, and a full series of radiographs. With this information, the student develops a treatment plan which must be approved by the patient and the preceptor. The approved treatment plan is documented on the TREATMENT PLAN REPORT FORM and forwarded to the Dental Data Center for entry into the computer. The

see COMPUTER MATCHING, page 9

CYBER-LETTERS

Dear Editor:

The main CAI and data processing activities at Northwestern University Dental School have been initiated and directed by the Department of Biological Materials. Dr. Greener, the department chairman, initiated this activity and CAI lessons in the area of dental materials and dental hygiene instruction have been developed as referenced in the NIH publication.

Most of the source programming has been written by myself and Mr. Randell Vitek, one of our dental students. The programming language has been PLATO TUTOR IV. We have available at Northwestern a simulation of the University of Illinois PLATO project for time share processing at the Northwestern University Computer Center (Vogelback). We also have access to a PLATO IV terminal connected to the University of Illinois machine (at the Northwestern University Center for the Teaching Professions, Evanston, Illinois).

Our main programming activities have been:

1. Review quizzes with tutorial responses in the area of dental materials.

. Tutorial lessons in dental aterials.

. A computer interface to allow uthoring lessons in TUTOR IV anguage with no computer experience r knowledge of programming language.

. Programs for history taking for ral diagnosis.

. Patient record keeping, data etrieval, patient-student ssignment.

Although much of our work could be used only at other installations with access to either the University of Illinois PLATO system or with a CDC 6400 machine, we would be pleased to correspond with any others interested in our work.

Queries should be directed to:

Dr. B. Keith Moore
Department of Biological Materials
Northwestern University Dental School
311 E. Chicago Ave.
Chicago, Illinois 60611

COMPUTER MATCHING

(continued from page 8)

Code on Dental Procedures and Nomenclature published by the American Dental Association (JADA 85:790-792, Oct 1972) is used as a procedure list.

As the student performs clinical services a Treatment Card is forwarded to the Dental Data Center for each procedure, patient, or clinic session (whichever occurs more frequently). Carefully defined steps indicate progress in procedures which cannot be completed in a single clinic session.

Regular reports (computer printouts) are furnished to each student and each preceptor so that they may monitor the progress of patients assigned to them. The Assistant Dean for Academic affairs and the Superintendent of Clinics are provided with both types of printout for their use in overall supervision of the system.

C.E.C.

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Winter 1973

CAI at Kentucky

COMPUTER-ASSISTED INSTRUCTION AT THE UNIVERSITY OF KENTUCKY COLLEGE OF DENTISTRY

(Editor's comment: In the Spring 1973 issue of CYBERDENT, a short item appeared on CAI at Kentucky with a promise of more information in a later issue. CYBERDENT is pleased to make good on that promise, thanks to the staff listed at the end of the article.)

At the University of Kentucky College of Dentistry the primary purposes for using CAI are to: (1) shorten the curriculum, (2) salvage students in academic difficulty, (3) allow students to proceed at their own pace, and (4) free faculty for more hours of individualized instruction

The equipment employed consists of three (eventually there will be five) Courier Executerm 260 CRT-Display Terminals, designed for remote operation utilizing a Multi-Station Adapter (MSA), which is connected by a leased telephone line to an IBM System 360 Model 65 computer in the University of Kentucky Computing Center on the central campus. The computer language used is Coursewriter III, Version 3. Programs in endodontic diagnostic problem solving, Oral Pathology, Oral Diagnosis, Community Dentistry and Anesthesiology presently have been developed.

Each student can progress as rapidly as he

(see CAI AT KENTUCKY, p. 3)

Good Data Needed

MEDICAL DATA: POOR SYSTEM, GREAT POTENTIAL

MD SAYS COMPUTER USING 'GOOD DATA' IS TOOL TO HELP IMPROVE PATIENT CARE

(Abstracted from American Medical News, November 12,1973)

Why can't the computer be used to improve the quality of patient care?

Carmault B. (Jack) Jackson Jr., MD, started asking himself this question after he left the National Aeronautics and Space Administration and went into private medical practice in San Antonio, Texas. He's been looking for answers ever since And his work is beginning to draw national attention.

He is a consultant to the U. S. National Committee on Vital and Health Statistics. His expertise has been sought by members of the subcommittee on data of the National Advisory Committee on Professional Standards Review. He is a member of the American Medical Association's Advisory Committee on Professional Standards Review Organizations, and serves as chairman of that committee's task force on data.

He is a member of the editorial board for CURRENT PROCEDURAL TERMINOLOGY (CPT), the AMA's manual for coding and reporting physicians' services. And he has worked

(See GOOD DATA, p. 4)

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Chapel Hill, North Carolina

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Submit material for publication to the Associate Editor indicated or the Editor. For matters pertaining to circulation, write to Miss Karen Scarlett, UNC School of Dentistry, Chapel Hill, North Carolina 27514.

HAPPY HOLIDAYS

AMA Inquiry System

(From American Medical News, Sept. 17, 1973)

New on-line computer inquiry facility for the American Medical Association Members Retirement Plan is now in service. The computer facility contains records of some 13,000 physicians involving approximately $140 million in funds. The system provides immediate referral when members request information. Darrel J. Fasey, MRP manager, forecasts more than $200 million in physician funds in the plan within the next two years.

EDITORIAL

I/O BOUND STILL?

It was recently revealed by IBM that their scientists have developed an electronic switch which can operate at ten-trillionths of a second, 100 times faster than the transistors now used in computers. However, impact printers are still limping along at 1100 lines per minute and keypunching speed seems pale by comparison. Of course, there's computer output microfilm and optical character readers, but have you looked at the price tag?

Do we really have to wait until 2001 A.D. to get I/O devices that listen and talk in human language, such as the peripherals attached to HAL in the movie "2001 A.D.", or is that too much to ask?

Josephson, Esaki, and Giaever received the 1973 Nobel Prize in Physics for work in electronic tunneling that served as the basis for the faster electronic switch. It is hoped that in a few years a similar award can be made to the scientists who develop inexpensive and versatile voice interpreters and synthesizers.

C.E.C.

CYBER-MEETINGS

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(more CAI AT KENTUCKY, continued from page 1)

is able or as slowly as necessary. In most courses he can take the examinations in the course whenever he feels he is ready.

In addition to its teaching function, the computer can perform other tasks essential to the student's attainment of the objectives of a course (Computer-Managed Instruction). If a student is having difficulty in a particular area, the computer will detect this and direct him to other learning aids, such as textbooks, programmed texts, single-concept videotapes, films, etc. The computer also can administer and score tests, give the student feedback and keep records of his progress.

COURSES AVAILABLE

DEMONSTRATION - A 15-minute course used to introduce visitors, faculty, and students to the environment of the terminal and to demonstrate programming capabilities.

ENDODONTICS - Sixteen problems from the third-year endodontic technique course present simulated patients and their symptoms and history. Slides supplement the CAI presentation. The student "orders" particular diagnostic tests, the computer gives him the results of the tests and, if the student has obtained sufficient and appropriate information, he is able to make a diagnosis and write a treatment plan.

DENTAL PRACTICE ENVIRONMENT - Two CAI lessons supplement this individualized course. A community situation is simulated and the student is asked to answer questions based on the required reading.

ORAL PATHOLOGY - Eight sections represent the entire third-year Oral Pathology course. Facts and questions are presented by the computer with slides as a supplement.

ANATOMICAL LANDMARKS - A review of the oral anatomical landmarks for junior dental hygiene students and first-year dental students. Diagrams give a quick review of the subject. The computer appropriately responds to the students' correct and incorrect identifications.

ANESTHESIOLOGY - Two CAI lessons are given as part of the individualized course in Anesthesiology. The lessons simulate patients requiring local anesthesia. The students answer questions related to anatomy, pharmacology, local anesthetic injections and emergency treatment.

OPERATIVE DENTISTRY - Three sets of questions taken from released National Board Examinations in Operative Dentistry are presented to the student, giving explanations of correct and incorrect answers. The student is given his score and appropriate comments concerning need for additional study relative to a previous year's Board scores.

BIOCHEMISTRY - A CAI program consisting of questions taken from a released National Board Exam in Biochemistry is being prepared. The format will be the same as the Operative Dentistry program.

SPECIFIC INFORMATION

Equipment (Main frame)

IBM System 360 Model 65 Computer with an IBM 2701 adapter, located at the University of Kentucky Computing Center.

Equipment (Interactive)

Three Courier Executerm 260 CRT-Display Terminals utilizing a Multi-Station Adapter (MSA) which is connected to the computer by a leased telephone line.

Location

The three terminals and MSA are on tables located in the front of one of the rooms in the UKCD Study Center. Because the keyboards are silent, the terminals can be operated in the study area without disturbing other students.

Costs

The total cost of the computer time and rental of the terminals varies according to the amount of computer time used, but has been approximately $1000 per month.

Programming

The faculty member plans the course and outlines the computerized lessons, deciding what action should be taken for each student response. The programmer encodes the course in the Coursewriter III, Version 3 language, and it is entered into the computer.

STAFF

Dr. Timothy A. Smith is Director of C. A. I., Mrs. Harriet R. Dobbins is C. A. I. Systems Analyst, and Mrs. Lynne Dolan is Data Processing Coordinator.

(more GOOD DATA, continued from page 1)

with the AMA's Burgess L. Gordon, MD, on forthcoming revisions in CURRENT MEDICAL INFORMATION AND TERMINOLOGY (CMIT), a system for naming, describing, and coding diseases.

Dr. Jackson also is founder and president of Computer Oriented Medical Programs and Storage (COMPAS), Inc., a three-year-old, San Antonio-based firm specializing in data processing and systems consulting.

"The computer," he says, "can integrate many, many pieces of variable data. And the computer can do it consistently." Putting this tool to work for practicing physicians and their patients can be done, not only in major hospitals and medical centers, but in the primary care setting as well. The key, he says, is good medical data--data based on what real doctors are seeing and doing in actual practice, within a system designed by and for medicine. Given this kind of data, Dr. Jackson adds, the information possibilities are virtually unlimited.

Imagine one simple form, consisting of little more than some check marks and a code number or two, yet capable of generating all the data needed by peer reviewers, payers, administrators, statisticians, health planners, government agencies, and, most important of all, practicing physicians.

With this form, a computer automatically handles the doctor's billing and accounting. It also fills out the necessary insurance claim forms. It may become possible to do away with paper documentation altogether; conceivably, the whole documentation-payment cycle could be run on computer tape.

The underlying assumption in all of this is "good medical data." Well, in Dr. Jackson's view, today's data is almost worthless from a medical standpoint.

"Source data collection is the key," says Hank Daughtry. "It's a generally established rule that the closer to the source you can collect data, the better the quality of that data. In medicine, source data is best collected by the doctor at the time he sees a patient."

But the quest for good data does not end with source data collection. If computers are going to handle medical data, doctors will have to learn how to speak to computers.

Computers can absorb alphabetic data--meaning written narratives--and they can store it. But, the computer's long suit is its ability to integrate related variables. This ability is easily compromised by alphabetic data, and medicine offers a classic illustration of why.

According to the AMA's Dr. Burgess Gordon, physicians are using about 28,000 different names for less than 3,600 identifiable diseases. And if the vocabulary is expanded to include ill-defined conditions and symptoms as well as diseases, he says, the number of narrative descriptions increases to 170,000. In other words, it is rare to find two doctors with the same medical vocabularies.

"We can't expect the computer to handle this kind of narrative," Dr. Gordon exclaims. "Oh, it could be done; but only at great expense. And you'd wind up with something that would choke 5,000 horses."

That's what the AMA's CURRENT MEDICAL INFORMATION AND TERMINOLOGY is all about: an attempt to bring order, logic, and uniformity to medical language, and to provide the numerical codes that will adapt the language to electronic data processing.

What's needed, in Dr. Jackson's view, is a common coding system. It is a widely shared view; but there is disagreement over which code should be the common one.

Still another problem is the physician's ability to generate data. It is not unlimited. Only the demand for data is unlimited. Sooner or later, then, an attempt must be made to formulate the minimum amount of data that must be reported to meet existing needs.

Confidentiality is another problem. With all this data being generated, who should control it? Who should manage it? Who should have access to it, and for what purpose?

Dr. Jackson believes that all these problems are going to be solved, probably very soon. He indicates that Professional Standards Review Organization will be a major force in the search for solutions, because they will intensify the need for accurate, comprehensive data, uniformly reported.

And " ... it will improve the quality of patient care."

Dentist Uses Computer In His Practice

THE COMPUTER AGE IN DENTAL PRACTICE

(Abstracted with permission from an article by Werner H. Beyer in DENTAL MANAGEMENT for October, c 1973 by Harcourt Brace Jovanovich.)

"Computerized, multi-office group practice."

Group practice makes it possible to centralize the administration of private practice and thus to improve the handling of business matters--while increasing diagnostic and treatment time. A group practice may include satellite offices, which shortens the distance patients must travel to their dentist's office. The reason for the computerization is equally simple: It's the easiest way to handle the financial recordkeeping.

The patient registration procedure includes assigning a patient-identity code number. The computer is more efficient with numbers than with words or names

Some group practices have actually bought or leased their own computer which may be a mistake. It's probably less costly and certainly less fuss to buy just the service, not the hardware and the technicians who accompany it. The Uxbridge Corporation, based in Stamford, Connecticut, has doctor-clients throughout the Northeast

As far as financial recordkeeping goes, the number of offices doesn't matter; the routine is still simple, the data complete. All billing and collections are supervised by just one business manager, out of one office. Uxbridge prepares the monthly statements along with the accompanying reports. With just one person in charge of the billing and collections, financial relationships with patients can be expert, uniform, and consistently fair.

PROCEDURE

When the dentist is with a patient, the chairside assistant fills in a charge slip, checking the name of the doctor or hygienist who saw the patient and the services rendered. The patient delivers it to the financial secretary or business manager. The dentist never needs to touch a pencil. At the end of the billing month, patients are not only billed but reports are prepared by the computer service. One totals the various services rendered by each doctor and hygienist during the month, and the value of those services. Thus computers make it easy to keep on top of who's doing what--even in a group practice with satellite offices in several states.

The computer has eliminated any need for ledger cards. Patient identity, service rendered, and fee are captured on the slip by an embossing machine and a plastic card, much the same way your credit card number is imprinted by a similar machine at a hotel or restaurant.

At day's end, all the imprinted forms showing services rendered and payments received during the day go into a mailing envelope. The computer prints the daily journal, which is mailed back for review.

The computer prints a better-looking statement than either a photocopier or a microfilm printer, and it also prints out the daily journal and a ledger report that takes the place of ledger cards. The computer, rather than aides, does all the posting. An aide ends the day's accounts-receivable recordkeeping by dropping off the mailing envelope at the post office. This is done daily because the computer people like to see a steady flow of work coming in throughout the month.

Computer billing costs less because overtime and catch-up work have been eliminated. The direct and indirect costs of billing aren't easy to determine; various estimates are in print, ranging to a dollar or more per monthly statement, including payroll, office space and equipment used, supplies and postage. Uxbridge's services cost roughly 35 cents per statement, including postage. Overhead isn't nearly as significant as net income, and it sometimes pays to spend more in order to net more. And what is the extra value of providing more personal attention to patients? The computer helps do that; its impersonality helps develop closer personal relationships.

Dentistry continues to become increasingly involved with third-party payments and insurance forms, which means still more insurance forms for an aide--or a computer--to contend with. For years now, health insurers have been paying doctors on the basis of information conveyed by doctors' computer-prepared statements, either submitted directly or attached to the insurer's form.

Selecting a Data Processing Service Bureau

HOW COMPUTER SERVICES VARY

(Reprinted with permission from DENTAL MANAGEMENT for October, c 1973 by Harcourt Brace Jovanovich.)

One principal difference among the numerous computer billing firms around the U. S is the way information gets from the doctor's office to the billing firm. Some firms use the mails; others, telephone or telegraph lines.

Uxbridge Professional Services, Inc., the regionally marketed billing system discussed by Dr. Werner H. Beyer in the accompanying article, uses the mails. So do three big billing firms offering services nationwide--Data Service Agency,Inc., of St Louis, Mo., Professional Budget Plan (PBP), of Madison, Wis., and Systemedics, Inc , of Princeton, N. J.

A look at the services offered by those three provides a useful comparison to any dentist considering computer billing service, since the three are among the nation's largest and most experienced and thus may be considered among the leaders in their field. In terms of number of physicians and dentists being served, Systemedics is generally conceded to be the largest, while PBP, which has specialized in management services to dentists for 35 years, has the largest number of dental clients on computer billing.

The three firms differ slightly in what's mailed into their data centers. PBP's doctors mail the daysheet; Data Service's the day's charge slips, while clients of Systemedics have the option of sending either daysheets or charge slips. An advantage in using the mails rather than phone or telegraph transmission is lower cost, since postage costs less than line charges and transmission-equipment rental--typically $5 or so monthly for postage as against $30 or more for electrical transmission, plus aide time spent transmitting the data.

Other features found in the services offered by the three leaders also have much in common. Some features are of course found almost universally among both the leaders and the lesser computer billing firms--for instance, computer-printed journals and patient ledger reports and the enclosing of a return envelope with each patient's monthly statement. But other features offered by all three leaders are found less often elsewhere. Examples include the ability:

1. To handle budget payments, as when a patient agrees to pay in monthly installments. Not every billing firm can show the total account balance and request payment only of the current installment due.

2. To provide a report of production (i.e., the dollar value of services rendered), both by total practice and individual doctor.

3. To provide not only accounts-receivable recordkeeping but also disbursements bookkeeping, including preparation of a computer-printed profit and loss statement.

Also, many of the smaller billing firms have neither experience in nor planning for computer-prepared health insurance forms. All three of the leaders say they'll soon provide clients with dental insurance reports. Data Service Agency and Systemedics have long provided medical insurance reports to their physician-clients.

Those two firms can also provide dental clients with "pre-collection" or dunning notes mailed separately from the monthly statements. By comparison, most other billing firms either print dunning messages directly or provide no dunning service at all.

Both PBP and Systemedics can provide doctor-clients with computer-addressed, computer-printed postcards reminding patients that it's time for a periodic check-up Also, both are considered leaders in the computerized preparation of useful management data. PBP's quarterly "practice profile", for instance, breaks down the income, expense, and time devoted to various specified lab and professional services and also reports on production, collections, specified items of expense, and net income.

Over the years, the principal complaint against computer-billing firms is their unhappy tendency to go bankrupt or otherwise terminate services--usally within a year or two, and almost always at great expense and aggravation to their doctor-clients. Data Service Agency has provided doctors with computer services for 10 years; PBP, for 8; Systemedics, for 9.

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CYBER-LETTERS

To the Editor:

I read with interest your editorial regarding the problem oriented record that appeared in a recent issue of CYBERDENT.

I agree wholeheartedly with your concept of the value of the problem oriented record. Its adaptability to data processing is particularly evident. However, I must take issue with your concept that "there is no way to locate patient records except by name or number."

It has long been a practice of medical record practitioners to code and index diagnoses and operations. In the early days of medical records, the Standard Nomenclature of Diseases and Operations was the primary tool used for this purpose. Other coding methods and systems have also developed. Indeed, in most recent years, computer services such as the Commission on Professional and Hospital Activities in Ann Arbor, Michigan have become valuable aids for the output of health statistics of all kinds.

Practitioners in the field of medical records have been doing research and supplying statistics to physicians, health and government agencies since our profession emerged.

I would also note that while the problem oriented medical record is comprehensive, concise and logical and simplifies review by physicians and his colleagues, it in no way effects "Dr. X's writing" which is "impossible to read." Dr. X's writing will continue to be impossible to read no matter what format he uses to write in the medical record.

Dental records may indeed contain valuable information that is difficult or impossible to retrieve. But medical records in hospitals have always been a source of retrievable and useful information and will probably become even more valuable in the future.

(Mrs.) Jeanette C Linck, RRA
Medical Record Technician Program
Ferris State College
Big Rapids, Michigan 49307

Editor's Comment: the efforts of medical record practitioners surely deserve recognition. The editor did not belittle their activities. However, the editor challenges Mrs. Linck or any other reader to find and report any dental installation that is using The Standard Nomenclature of Diseases and Operations (or any similar classification) for a routine, production type of record, that is, one that lends itself to retroactive investigation, rather than requiring special procedures over the period of the project.

Education via Satellite

Dental education programs will be broadcast via satellite to a network of U. S and Canadian dental schools and resource centers by the spring of 1976, as a result of an agreement between the National Aeronautics and Space Administration and the Department of Health, Education, and Welfare.

The Division of Dental Health, Health Resources Administration, HEW will receive transmission time for dental education experimentation on NASA's Communications Technology Satellite. Positioned 22,500 miles above the earth, it is capable of sending color television pictures to special receivers within a 1,000,000 square mile area.

Use of the satellite will make it possible at comparatively low cost for U. S and Canadian schools to share courses of study and to transmit information to schools training dental auxiliaries in remote areas. Plans call for exchanging lectures, disseminating audiovisual materials and experimenting with the use of computers for instruction.

Educational information also will be transmitted to schools from three regional resources centers: the Division's Dental Health Center in San Francisco, where the experiment will be coordinated; the National Medical Audiovisual Center in Atlanta; and the University of Missouri at Kansas City.

Jaw Growth Studied

JAW GROWTH IN THE DOG--A STUDY USING A COMPUTER-BASED, THREE-DIMENSIONAL RECONSTRUCTION TECHNIQUE

P. G. Sullivan, London Hospital Dental School

(Abstracted from an article in the Journal of Dental Research 52: 931, Sept.-Oct. 1973.)

Growth changes that occur in the jaws of the dog were recorded by means of an intravital fluorescent dye technique, and by radiography with the Intercol point projection X-ray microscope. The outlines of structures found in serial sections were recorded in numerical form on punched paper tape by tracing on an electronic X-Y coordinate plotting table. A computer was used to reform a three-dimensional reconstruction on magnetic tape for subsequent analysis and measurement. This analysis included cutting "computer" sections at any plane, drawing the required section by the use of a computer-driven graph plotting instrument (Calcomp 365), and calculating the areas and volumes of structures. Thus it was possible to follow the three-dimensional progress of a forming front in the bone in individuals and in a series of littermates by the use of the computer. The stages and date of formation of the teeth throughout the jaws also were demonstrated.

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UNC SYSTEM SMOOTH

A DENTAL CLINIC COMPUTER SYSTEM THAT WORKS

By C. E. Crandell, D.D.S.

THE BEGINNING

In 1958, the University of North Carolina installed a Univac 1105 computer, one of the most advanced electronic computing devices then available. It was designated as one of the centers where the 1960 United States Census data would be processed. It was an extremely large machine, consisting of thousands of vacuum tubes, and requiring an enormous amount of maintenance and air conditioning.

The Dean of the School of Dentistry at that time was Dr. John C. Brauer, who was widely recognized for his work in the utilization of auxiliary personnel. Dr. Brauer was innovative in many other ways and his interest in computers led him to investigate the feasibility of the application of data processing in the operation of the School of Dentistry. The author of this paper was asked to direct this study in the Fall of 1959.

A search of the literature revealed little activity in dentistry with computers. The only things going seemed to be clinical reporting systems at the University of Oregon which was essentially a unit-record system based on mark-sense cards and an in-house IBM machine (J. Dent. Educ., 21: 366-372, Nov. 1957), and a similar system at the University of Alabama (J. Dent. Educ., 21: 372-380, Nov. 1957).

The systems analysis and development, therefore, consisted of determining local needs, comparing those needs with the published experiences, considering the opportunities available on the Univac 1105, and suggesting a plan which produced the best match between needs and opportunities. The report was written and presented to Dr. Brauer in the Spring of 1960. In essence, he said, "You have a good study and a fine plan, but--you're a dreamer; it is not feasible." Considering a non-participatory type of management and a budget almost entirely devoid of federal funds, his decision, in retrospect seems automatic. So the plan was filed away because it was infeasible. Filed away, but not forgotten.

In the meantime, the University's Computation Center struggled to maintain viability. Third generation equipment was installed. The pulse of computing quickened, respiration increased, both in volume and pace; the infeasible became negotiable.

In 1966, Dean Brauer retired. The new Dean, James W. Bawden, was also a leader. He retrieved the 1960 study and decided it had to be implemented. Dr. Bawden needed automatic data processing to support his concepts of the new curriculum: total patient care must be based on the idea that students treat patients, not accomplish certain quantities of dental procedures; that the emphasis should be on maintaining health and preventing disease, not just treating disease. While the departmental records showed that students were performing dental procedures at a quality and quantity acceptable for promotion and graduation, there were no formal measures of competency in patient management or the ability to assimilate a collection of procedures into an effective program for the dental health of an individual patient. There was substantial evidence to indicate that this phase of the curriculum was inadequate for

(see UNC, page 4)

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METRIC CONVERSION

GOING METRIC? HELP IS AVAILABLE!

The United States is one of the last principal countries that has not converted to the metric system of measurements. A concerted effort by both public and private institutions is now under way toward making the conversion over the next ten years. To assist in this effort, the National Bureau of Standards has made available a computer program which will help in the conversion to metric measurements. The program is written in Fortran (ANS Double Precision) and can be run on a broad spectrum of hardware. To cover expenses, a small fee will be charged. Caterpillar Tractor Company originally developed this program to convert metric units to their US equivalents on their engineering drawings, according to a recent article in "Computer Decisions" (6:8, January 1974).

EDITORIAL

THE FUTURE OF CYBERDENT

The American Fund for Dental Education has recently granted the Editor sufficient funds to publish CYBERDENT for a second year. It is anticipated that the publication will improve in appearance and circulation and newsworthiness so as to receive an additional award approximately nine months from now, early 1975, for a third year of publication. These funds have enabled CYBERDENT to be published and distributed free of charge to over 400 persons who have an interest in data processing as it applies to dental education and dentistry.

It is not too early to consider what might happen to CYBERDENT at the end of the three year support from the American Fund for Dental Education. The purpose of this grant, and many others of this type, is to support innovative approaches to information dissemination during the developmental and initiation stages. Such support is temporary, in anticipation of securing more permanent funding or better still, to become self-sustaining.

Various means have been explored toward this end. An intriguing possibility would be the creation of a special interest committee (SIC) or special interest group (SIG) on dentistry or dental education within the framework of the Association for Computing Machinery (ACM). Since ACM is one of the stronger organizations in the data processing field, it appears that association with ACM would be beneficial. A SIC is chartered for one year to find out by experience whether it can be a viable organization. Its goal is to be converted to a SIG. A SIG collects dues from its members, issues newsletters at regular intervals, organizes workshops and symposia, and operates in a semi-autonomous manner.

The constitutional requirements for formation of a SIC are: (1) a petition to the ACM Council containing signatures of 50 or more full ACM members, and (2) the recommendation of the SIG/SIC Board. The petition would consist of a short proposal outlining the ways in which computers are used in dentistry and dental education, the purposes of the proposed SIC, and other information considered pertinent by the petitioners.

In order to determine the interest in pursuing this kind of organizational effort, a brief questionnaire is published in this issue of CYBERDENT on the reverse side of the mailing panel. Your cooperation in returning the questionnaire by May 1 will be appreciated. The results of the survey and future activities in this direction will be reported in future issues of CYBERDENT.

Computer in Dental Practice

HOW COMPUTERIZED BILLING CAN CONSERVE STAFF TIME, ENERGY

The tedious task of preparing monthly statements has been streamlined considerably under a system set up by Dr. Paul B. Menges of Castro Valley, California. The system, based upon a computer service set up by Dr. Menges, eliminates all manual operations required in preparing monthly statements.

After years of relying on the traditional method of having ledger cards copied and mailed each month, Dr. Menges sought a means of reducing these routine manual operations in order to speed up the process, increase efficiency and reduce administrative costs.

Use of a computer seemed logical, but the cost of such equipment was beyond the means of the individual dentist. However, he reasoned that if the statements for a number of dentists could be entered into a computer system, they could be prepared speedily and economically by group runs.

After receiving favorable reaction to the idea from other dentists, Dr. Menges established Dental Data Systems, Inc., a professional data processing service for dentists, with William R. Quiner, a data processing specialist, as a partner. An IBM System 3 computer was installed, and David C. Anderson of Moore Business Forms, Inc., was called in to assist in the design and technical specifications of the data processing forms required.

Dentists who have joined the system are furnished with a supply of transaction slips, which are one-part forms with carbonized areas on the back. They are constructed so that the right stub can be folded around a standard patient record card used by the dentist. The required data is handwritten on a slip and it copies through to the patient record card by means of the carbonized backing areas.

At the end of each day all transaction slips are sent to Dental Data Systems, where the information from each dentist is keypunched and entered into the computer. At billing time the accounts for each dentists are processed by computer and an all-in-one statement for each account is automatically printed out. The statement--a six-part Moore Speedimailer form--includes a self-mailer, the patient statement and a return envelope, all processed on a single run through the computer.

Upon completion of the run, the pack of continuous statements is sent to the dentist for review and addition of any desired remarks. The dentist writes any notations in the area below the patient's name and address, and such remarks automatically copy through to the statement, which was enclosed within the mailer during the manufacturing process. Dental Data Systems then picks up the bulk statements from the dentist, removes the punched margins on each side and detaches them into individual sets. Part one is retained for office records and the balance (parts two through six) are mailed under a first class mailing permit, eliminating the necessity of applying postage.

When the patient receives his portion of the form he follows the printed instructions--"Hold Firmly Here" on the right end, and "Grasp And Snap" on the left end. When this is done, part three, the statement, and parts four and five, the return envelope, are extracted.

The remittance is inserted in the open end of the return envelope, a protective strip is peeled off a section of transfer tape which contains a pressure sensitive adhesive coating, and the end is folded over and sealed with a firm pressure. Postage is applied and it is ready to mail, since the dentist's address and the patient's address and account number have been automatically printed out on the computer.

In addition to eliminating manual operations, speeding up processing and eliminating transcribing errors, Dr. Menges says, the system has resulted in faster payments, due to the convenience of return envelopes, and more positive identification of accounts.

Funds for Computer Research

GRANTS FOR COMPUTING ACTIVITIES

The Office of Computing Activities (OCA) of the National Science Foundation (NSF) administers programs which support basic research in computer science and engineering, in advanced computer-based research techniques, and in the impact of the computer on organizations and the individual. A brochure (NSF 73-13) describing the programs and providing information useful in the preparation of proposals is available upon request from the National Science Foundation, Washington, DC 20550.

The brochure gives brief descriptions of the programs listed below, which are intended to be suggestive rather than exhaustive. Projects may bridge several programs or deal with topics not explicitly mentioned. The primary emphasis of the research will determine which program will consider the proposal.

The computer science and engineering section of OCA consists of three programs which support basic research in the computer science and engineering areas: theoretical computer science program; software and programming systems program; and computer systems design program.

The computer applications in research section contains three programs which support research in advanced computer applications in scientific research: networking for science program; techniques and systems program; and software quality research program.

The computer impact on society section consists of two programs which support research on the impact of computers and computer technology on society: computer impact on organizations program; and computer impact on the individual program.

The program directors welcome informal correspondence and discussions preliminary to the submission of formal proposals. Inquiries should be addressed to the program responsible for the primary subject area of the proposal. There are no deadlines for submission of formal proposals to these programs, but six months should be allowed for completion of the evaluation and processing.

Proposals should be prepared in accordance with the guidelines contained in the NSF brochure *Grants for Scientific Research* (NSF 73-12 or subsequent revision). For consideration by the OCA, 20 copies of the proposal bearing the necessary institutional endorsements should be submitted to Central Processing Section, National Science Foundation, 1800 G St., N.W., Washington, DC 20550.

(UNC continued from page 1)

the dentist of the 1970's. Nor was there available a manual record-keeping system to keep track of the 20,000 patients being treated in the clinics.

PILOT PHASE

A research project was designed that would embrace the total patient care concept on a pilot basis for two years. Five third-year students were randomly selected in the first year of the project and five more third-year students participated in the second year. At the same time, a system was being designed which would follow these students and their patients, with the computer as the primary record-keeping tool. The feature of the system that made it unique, however, was the use of the followup data to automatically assign new patients to the students so as to provide them with a balanced clinical experience not unlike the old curriculum as far as the quantity of certain dental procedures was concerned.

In addition, the data base was to be used to demonstrate the feasibility of using linear programming techniques for the allocation of personnel, student, and facilities resources in a dental clinic.

It was originally estimated that this project would be completed in one year, including system design, collection of data, programming, and implementation. It took five times that long. Nevertheless, at the end of two years, it was decided that the concept of total patient care and the computer system that was to support it would be implemented one year at a time beginning in 1969. A new dental education building was occupied at the same time. Considering all the changes, it is amazing that there were any survivors; a new dean, a new building, a new curriculum, and a new system--all at the same time--was more than most would bear.

FULL IMPLEMENTATION PROBLEMS

During the first three years of implementation, the system worked smoothly. The number of students and patients on the system was not so large that manual controls wouldn't work and the error rate, though extremely high, was tolerated because of running dual as well as parallel systems. In the Fall of the fourth year under the new curriculum when the computer system was fully implemented, things started going downhill. Inadequate evaluation techniques for measuring competence in dental procedures within the overall patient management scheme reduced motivation to a critical level and in response to the crisis placed undue emphasis on quantities of dental procedures again as in the old curriculum. At the same time, the computer validation of input data was invoked, requiring that all treatments reported were part of a previously submitted treatment plan, causing the extremely high error rate to skyrocket to the unmanageable height of 69 per cent. A number of special actions were taken to correct this situation: hiring extra personnel, allowing overtime, withdrawing support of some programs, conducting many seminars for users, verification of inputs, and self-instruction materials for users.

In five months, control of the situation was again obtained and routine production of inputs and outputs was resumed, and on schedule. A number of steps were then taken over the next ten months to enhance the system: data preparation was transferred to an outside vendor, the programs were modularized, development and production personnel were administratively separated, daily validation runs were eliminated, a user's manual was written and distributed, versions of the system were documented, and automatic correction of insignificant errors was instituted. These changes substantially increased the credibility of the system; student, faculty, personnel, and administrative acceptance and support reached recognizable, even complimentary proportions. The most significant measure that can be reported to illustrate these gains is the error rate which dropped from 69 per cent to four per cent in 15 months.

What has been achieved is not just a working computer system, but a data processing system that can and does respond to needed changes, continually monitors itself, and constantly provides opportunities for improvement. Space and time limitations prohibit explaining in sufficient detail what this really means, but before the system is described, credit should be given to the users, the production staff, the development staff, and the consultants, Hydra Computer Corporation.

HOW THE STUDENT SCHEDULING SYSTEM WORKS

New patients desiring service are first seen in the Screening Clinic. A dental chart is made which includes a collection of vital statistics and health information. A Panorex film is made prior to a cursory clinical examination. Additional films may be made as required. For those patients whose dental health needs and social restrictions are acceptable, a MATCHING DIAGNOSIS FORM is completed and forwarded to the Dental Data Center. This form serves as a source document from which coded data is keypunched and entered into the computer where the patient is matched with a student needing the same services. An appropriate preceptor is assigned to each patient and the student and the preceptor are notified of the assignment by mail.

The student schedules the patient in Information Gathering Clinic and Radiology Clinic where he obtains a complete history, a thorough examination of soft and hard tissue, and a full series of radiographs. With this information, the student develops a treatment plan which must be approved by the patient and the preceptor. The approved treatment plan is documented on the TREATMENT PLAN REPORT FORM and forwarded to the Dental Data Center for entry into the computer.

As the student performs clinical services, a

(continued on page 5)

(continued from page 4)

TREATMENT CARD is forwarded to the Dental Data Center for each procedure, patient, or clinic session, (whichever occurs more frequently). Carefully defined steps indicate progress in procedures which cannot be completed in a single clinic session.

Each week, the student receives a Report (computer printout). Depending on the nature of transactions, the report may have several sections:

1. New patient assignments
2. Treatment (Activity) cards processed
3. Treatment cards rejected
4. Treatment plan accepted
5. Treatment plan rejected
6. Revised treatment plan accepted

Progress reports (computer printout) are furnished to each student and and each preceptor so that they may monitor the progress of patients assigned to them. The Assistant Dean for Academic Affairs and the Director of Clinics are provided with both types of printout for their use in overall supervision of the System; in addition, they receive several special reports of an administrative nature.

More than 25 different reports are regularly produced. Perhaps most useful is the Patient Progress Profile Report which is printed at the middle and end of each semester and on one page depicts the progress a student has made in the treatment of all patients assigned to him. Other reports display grades, units of work planned, started, or completed, last date of patient visit, and many other items of information for which the faculty has identified a need or desire.

When a student graduates, strenuous effort is made to reassign his patients so that continuous service is maintained.

STUDENT USAGE

The weekly printout also has a message block so that users' attention can be directed to changes or problems in the system or compliments for such things as submission of good data.

When the weekly printout contains sections on "Treatment Cards Rejected" or "Treatment Plan Rejected", the reason for the rejection is listed. The student corrects his errors by making the required changes on the printout itself and resubmitting the data. The computer program makes the indicated changes in the next run. If errors are not corrected by student intervention, another computer program called ACE (Automatic Correction of Errors) defaults to previously published values and keeps track of both manual and automatic corrections to make users aware of usage and possible abuse of the system.

FUTURE PLANS

Although keying input data is the most prevalent system in use and the error rate in this system has been excellent, other input methods show promise. Plans are being made to develop OCR (Optical Character Reading) input documents that will bypass the keypunching, with improvement in turnaround and cost. Simultaneously, the number of different types of clinical input forms will be reduced, agreement problems between parallel, dual, and computer systems will be solved, and forms design will simplify and reduce manual entries.

SYSTEM DEVELOPMENT

The need for the separation of Development and Production operations and staff is best illustrated by documenting the Development process. The Development staff meets monthly to report progress on work being done, consider new programming requests, and to discuss other items of concern. Each programming request carries an estimated cost and value, estimated hours to complete, description of project, justification, and other data. The staff assigns a priority based on all these factors and schedules the request for a staff member, whose hours are completely assigned except for known holidays, vacations, and other exemptions. The following month at the development meeting, progress on assigned work is reported and the cycle is repeated. Interim checks on progress are made on a required basis where projects impact or affect each other. Comprehensive review of areas of impact is conducted as a part of the systems analysis of all programming requests.

HARDWARE AND SOFTWARE AND FINANCES

The system runs on an IBM 360 Model 75 computer; the programs are written in PL/I. It would be possible to translate the program into Cobol for running on non-IBM mainframes. The programs have many optional and variable parameters so that clinic administrators and department chairmen can vary the outputs by requests to the production staff. Pre-processor programs can alter inputs as needed to fit the existing random access index sequential file organization. Unique inquiries into the data files are possible.

Direct computer processing costs are averaging $845 per month for production and $865 per month for development. Production staff consists of one data processing clerk. Development staff consists of one programmer, one secretary, and one dentist. The total investment in the system is more than $500,000 over the seven-year period; its value is thought to be much more than that.

SUMMARY

The Student Scheduling System has been briefly described; some of its problems and solutions have been discussed. A mechanism for constantly controlling and improving the system has also been presented. This product (the total system, including development, testing, installing, and maintaining) represents a considerable investment. It is sufficiently flexible that it could be readily adapted by other schools, hospitals, or health facilities.

ORSA Health Panel

THEORY OVER-EMPHASIZED IN OPERATIONS RESEARCH HEALTH CARE WORK

San Diego--The 44th National Meeting of the Operations Research Society of America met November 12-14, 1973. A workshop session on the problems and the delivery of health care attracted a standing-room-only audience for an hour and a half.

Several problems were identified in the relationship between health care delivery and operations research. The consensus was that theory was over-emphasized in the health care literature. Journal editors recognize their responsibility and function to provide publication incentive for reports of operations research in health care delivery, but indicated that the quality of papers presently being received in this area is very poor. It was also reported that the useful literature that is available is not generally known to health care practitioners, teachers, and health planners who could best use it. It was proposed that the health applications section of ORSA should attempt to sponsor a well-publicized, comprehensive listing of literature in the field.

According to an article by David Whipple in "Health Newsletter" for January, 1974, there seems to be a lack of interaction between operations researchers and medical practitioners (no physicians attended the ORSA meeting). Another problem identified was the political constraints that may block the implementation of changes in the health care delivery system.

Safer Flying

FLIGHT TRAINING SIMULATION BY COMPUTER

Aircraft flight simulators have been in use for many years. Since the 1960's, digital computers have been used to drive these simulators. Recently the Navy Department installed an improved simulator that will provide visual and dimensional simulation for landing exercises on aircraft carriers. A picture of the carrier is displayed on a scope and changes to portray the approach of the simulated aircraft. The system is located at the Naval Training Equipment Center at Orlando, Florida. The trainees have considerable freedom in flight maneuvers before landing the aircraft on the simulated carrier. The system is fast enough to realistically create the illusion of motion even though the data base is composed of about 2,000 vectors, according to information in "Computer Decisions" (6:8, January 1974).

Heart Monitoring

COMPUTER-ASSISTED EKG

The interpretation of electrocardiograms has been determined to be successfully accomplished by a computer, according to a recent report "The Computer-assisted EKG, From Laboratory to Community," published by the Department of Health, Education, and Welfare. According to a report in "Computer Decisions" (6:8, January 1974), physicians have been characterized as reluctant to accept automated assistance in the diagnosis of illness. The physicians in this project, however, have accepted computer interpretation of electrocardiograms as a sophisticated augmentation of their own decision-making processes. In addition, the technique permits the EKG to have wider accessibility for patients and physicians. Another advantage is the ability to achieve uniformity in methodology, therefore assuring a measure of quality control.

A report describes a three year experiment involving 20 hospitals in Colorado, Kansas, Wyoming, and Nebraska which were connected to a central computer system in Denver. The hospitals were able to reduce the costs ($10 per EKG) and the time required (minutes) necessary to obtain these services. There is even speculation that this computerization of EKGs may make it feasible to use them as routine admissions procedures in hospitals or as screening procedures in health maintenance programs.

Lose Weight

COMPUTER DIET AND ACTIVITY PROGRAM

Counterweight is a widely advertised weight-loss program that includes a computer-prepared eating and activity program geared to a particular dieter's life style, food preferences, and physique. The weight-reduction plan was developed by General Mills and a team of nutritionists, physicians, and physical fitness experts. Those who join the program complete a questionnaire from which the computer prepares a suggested regimen. Nutritionists have assigned point values to all foods and each participant may eat anything he chooses but he is allowed only a certain amount of points each day in each food group. Classroom discussions on nutrition, diets, and psychological approaches are optionally available. Also included in the program is a newsletter containing articles on exercises and other facets of the program, according to an article in "Dental Products Report" for February.

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cut along this line and mail to CYBERDENT

Questionnaire on the future of CYBERDENT

1. CYBERDENT is a useful publication that should be continued after AFDE support. ☐ YES ☐ NO

2. If I had to pay for a subscription, I would be willing to pay . . . . $ ___________ per year.

3. I am a member of (check all that apply): ☐ ACM ☐ ORSA ☐ TIMS ☐ AADS ☐ DPMA ☐ ADA ☐ Other ___________

4. I am a full member of the Association for Computing Machinery and will sign a petition to form a Special Interest Committee/Group for dentistry.
☐ YES ☐ NO

____
Signature

CYBER-MEETINGS

ACM Southeastern Regional Meeting and Conference, April 18-20, 1974, Nashville, Tennessee. Contact: Charles L. Braishaw, Director, Computer Center, Vanderbilt University, Box 1577, Station B, Nashville, Tennessee 37235.

Association for Systems Management's 1974 Annual Conference, April 21-24, 1974, Dallas, Texas. Contact: Association for Systems Management, R. B. McCaffrey, 24587 Bagley Road, Cleveland, OH 44138.

ORSA/TIMS, April 22-24, 1974, Boston, Mass. Contact: Jerome D. Herniter, 212 Bay State Road, Room B-2, Boston, MA 02215.

1974 National Computer Conference and Exposition, May 6-10, 1974, Chicago, Illinois. Contact: S. S. Yau, Department of Computer Sciences, Northwestern University, Evanston, IL 60201.

Association for Educational Data Systems' 12th Annual Convention, May 7-10, 1974, New York, N. Y. Contact: Association for Educational Data Systems, Thomas A. Corr, Nassau Community College, Stewart Ave., Garden City, NY 11530.

1974 Conference of the Canadian Operations Research Society, May 27-29, 1974, Ottawa. Contact: Brian Carr, CORS 1974 Conference Committee, Department of Transport, Ottawa, Ontario, K1A 0N5, Canada.

The Systems Approach: Key to Successful Computer Applications, June 20, 1974, Gaithersburg, MD. Contact: Zella Rughberg, Room B255 Technology Building, National Bureau of Standards, Washington, DC 20234.

Self-Instruction Workshop, sponsored by the Eastern Dental Radiology Workshop, June 22-23, 1974, Pocono Manor, PA. Contact: C. E. Crandell, UNC School of Dentistry, Chapel Hill, N.C. 27514.

Info/Expo--DPMA 1974 Conference, June 24-26, 1974, Minneapolis, Minnesota. Contact: DPMA International Headquarters, John A. Guerrieri, Jr., 505 Busse Highway, Park Ridge, IL 60068.

1974 IFIP Congress, August 5-10, 1974, Stockholm, Sweden. Contact: U. S. Committee for IFIP Congress '74, Box 426, New Canaan, Connecticut 06840.

ORSA/TIMS, October 16-18, 1974, San Juan, Puerto Rico. Contact: Armando Riesco, Post Office Box 2342, Mayaguez, Puerto Rico 00708.

ACM 1974 Annual Conference, November 11-13, 1974, San Diego, California.

PRIORITIES IN CARE

RESEARCH NEEDS IN HEALTH CARE DELIVERY IDENTIFIED

Washington--The Bureau of Health Services (BHSR&E), HEW, has released a statement o program priorities for the major issues i health care delivery. The objectives o research in this area should fall into on of the five following categories:

1. Planning, regulation, and licensure. BHSR&E will support research in th assessment of specific regulatory approaches.

2. Productivity of health services. Research will be supported which attempts to fill in the gaps left by previous work, plus extending this work through the analysis o trade-off between implied policy options.

3. Economic analysis. Research will be supported which leads toward solutions to the problems of rising medical care costs, allocation of medical care resources, and the quality of care.

4. Quality of health care. Research will be supported which seeks to improve techniques for quality measurement and assurance of a high quality of care.

5. Health care data and information system. Research will be supported which appears to provide an adequate data base to support decision-making at various levels within the health care system.

Copies of the complete statement of the program priorities within the Bureau of Health Services may be obtained by writing to: DHEW, Public Health Service, Health Resources Administration, Rockville, Maryland, 20852.

Computer Inventory System

A computer-based system for maintainin inventory records has been announced b Leasco Response, Incorporated, according t an item appearing in "Dental Product Report" in February. Transactions ar entered on keyboard terminals located in th office, then the data is transmitted to th computer at a remote site that allow instant feedback. The system will maintai inventory records, produce detailed report relating to inventory value, location reorder requirements, and, according to th manufacturer, is very economical. Other available systems include general ledger payroll, accounts receivable, and time an cost accounting.

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CAI AT OHIO STATE

MEDICAL TERMINOLOGY THROUGH CAI

By Joseph R. Tebben, Ohio State University

A computer-assisted course in medical and technical terminology is currently in operation at The Ohio State University.

The object is to provide student proficiency in the specialized vocabularies of their disciplines by memorization and recognition of recurring components by drill and practice sessions, with corrective information provided by CAI . Most students seek practical, direct knowledge and have no interest in the linguistics; CAI is both direct and practical. The large number of students who can take a terminology course and the small number of instructors who must be assigned to such a course are other advantages.

The course is self-paced. There is no schedule. So long as students can achieve passing scores they can proceed in the course indefinitely. The faster students can finish quickly; slower students have until the last day of the quarter to finish. Mid-term and final examinations are offered at several points, not just at the end of the quarter. In addition, students may review as much and as often as they wish.

All of the students are interactive all the time. The CAI sessions are individualistic since each student gets a random selection of questions from large data banks which guarantees unique and non-repetitive stimulation. Four types of questions are asked. Mastery and reinforcement of the aterial is high. Incorrect answers are iagnosed and appropriate corrective nformation is given to the student to ssist him in achieving a correct answer, aking the course suitable for a broad range f academic levels.

(continued on page 3)

TEST ANALYSIS AT PITTSBURGH

COMPUTERIZED GRADING

By Thomas G. Zullo and Douglas M. Vaughan

Computerized grading and test analysis procedures are currently employed for all didactic testing at the University of Pittsburgh, School of Dental Medicine.

INPUT

Control Cards: Each objective item is identified by a consecutive sequence number, the correct answer, maximum number of options and the sub-test category. The sub-test category is particularly useful when scoring examinations dealing with biological systems. For example, while an examinaton may cover the digestive system, items can be further identified as being from Anatomy, Physiology, Pathology, etc. With the capability of identifying 29 separate categories. Control cards for essay questions require a consecutive sequence number and the maximum number of points possible.

Data: Response to all objective type items (true-false, multiple choice and matching) are recorded by the students on specially designed answer sheets (IBM H98904) to permit optical scanning by an IBM 1230 Optical Mark Scoring Reader. The answer sheet has a capacity for nine options to allow for matching type items. Students also record their identification number on the answer sheet. Punched cards generated by the Optical Reader are then used as the subsequent input to the "Test Grader" program. Scores for essay questions are keypunched separately for input.

(continued on page 3)

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Submit material for publication to the Associate Editor indicated or the Editor. For matters pertaining to circulation, write to Miss Karen Scarlett, UNC School of Dentistry, Chapel Hill, North Carolina 27514.

CYBER-MEETINGS

The Association for Development of Computer-Based Instructional Systems 1974 Summer Conference, August 13-15, 1974, Bellingham, Washington. Contact: Mrs. Joan Hayes, Computer Center, Western Washington State College, Bellingham, Washington 98225.

Summer Computer Simulation Conference, July 9-11, 1974, Houston, Texas. Contact: R. L. Motard, University of Houston, Houston, Texas 77004.

Workshop and Conference on Interactive Computer Graphics and ACM SIGCPR , July 13-19, 1974, Boulder, Colorado. Contact: Robert L. Sabiffiman, Computing Center, University of Colorado, Boulder, Colorado 80302.

INFO 74, September 9-12, 1974, New York. Contact: Clapp and Poliak, Inc., Exposition Management, 245 Park Avenue, New York, N. Y. 10017.

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(continued from page 4)

The appointment scheduling system is entirely on-line, utilizing one CRT terminal to schedule 80 to 100 appointments each day and to input all demographic information on new patients. This terminal is about 50 to 75 percent utilized. The computer pre-prints various forms needed during the patient's visit. The system can scan for the next available appointment, confirm and cancel appointments, find a specific patient's appointment, view and printout doctor's schedules, and retrieve names of patients who have missed appointments.

The business office system is entirely on-line; there is no hard copy ledger of the patient's account. One CRT terminal is used for inputting daily charges and receipts and a second CRT terminal is used for viewing the patient's accounts. At the time the charges are input, accounts needing insurance forms are queued for later printout. Insurance forms are then printed nightly and mailed to the patient for signature. Within 36 to 48 hours of the patient's visit, the insurance forms are mailed to them. The system automatically handles credit adjustments for any account covered by assignment rules if there are disallowed charges. The system also provides fee and receipt analysis, aged ccounts list, automatic letters for overdue ccounts, billing, various methods to esearch patient's accounts and has xtensive measures to protect patient's iles due to the on-line nature of the ystem.

atient response ranges from favorable to eutral; some older patients prefer to have heir history taken by their physician. The esponse of the clinic's physicians and ersonnel has changed from initial kepticism to complete endorsement specially about the medical aspects of the ystem.

he medical record system eliminates the eed for up to three additional personnel, he business office system allowed the eduction of the business office staff by hree people, and the scheduling system llowed one further reduction in staff. The omputer system has expedited and improved he ability to provide medical care. The hysician has more time to deal directly ith patient oriented problems. Any system hould be justified from a medical standpoint first and then from a business rientation.

(continued at top of page)

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It is important to educate personnel in the concepts of the computer, as well as the programs that they will be using. This system has allowed the personnel to spend more of their time dealing with patients and their problems, rather than record keeping and other ancillary functions.

The Clinic is willing to share its experience with others. Requests for information should be addressed to David H. Wilson, Cardiovascular Clinic, 3300 Northwest 56 Street, Oklahoma City, Oklahoma, 73112.

TEST ANALYSIS AT PITT (from page 3)

Individual Student Reports: The final section of output contains the following data for each student: identification number and name, his raw score and percentage score, the mean percentage score and number of points on the test. This is presented for the total test along with each sub-test category. The frequency distributions and roster portions of the printout are of use to the individual departments. With this information they can readily determine overall class performance on their portion of an examination and also have a record of each student's performance. The value of Item Analysis to individual instructors is to aid in improving validity and reliability. The final section of the output, Student Report, is of prime benefit to the student and his advisor. This allows for immediate observation as to how a student has performed on each section of the examination.

For further information, contact Dr. Thomas G. Zullo, School of Dental Medicine, University of Pittsburgh, Pittsburgh, Pennsylvania 15216.

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COMPUTER TALKS TO MD'S

DIVOTS VERBAL RESPONSE SYSTEM OPERATION

A computer system that responds verbally to telephoned instructions speeds the flow of patient information between doctor and laboratory in three Youngstown, Ohio hospitals enabling patients to save an extra day's hospital stay or arriving in surgery faster for critical operations.

DIVOTS (Data Input Voice Output Telephone System), the Youngstown Hospital Association's experimental communications network, connects physicians' offices, nursing stations, and key administrative offices to an IBM System/7, through a push button telephone system, which is connected to a larger computer which stores and processes central records; it also is linked to a "laboratory computer" which controls the automated test instruments in the laboratory.

The computerized verbal responses sound like the Association's director of laboratories, Dr. Arthur E. Rappoport, who has worked toward automated laboratory procedures for 10 years. The audio response unit contains 842 medical and routine English terms dictated by Dr. Rappoport.

Following examination of a patient, a doctor simply telephones the computer and keys in the patient's hospital number and desired laboratory tests using appropriate code numbers. The system verbally verifies the information that has been entered.

The "hospital computer" then remotely prints order labels in the laboratory, including patient's name, hospital and room number, and tests desired.

Laboratory technologists go to the patient, obtain the necessary specimens, and identify them with the order labels.

The specimens are tested on automated instruments which feed their readings directly into the "laboratory computer". These test findings in turn are transmitted back to the patient's master file in the "hospital computer."

The doctor can obtain test results immediately by using the same push button telephone procedure. As with the original verification of tests ordered, the system provides results verbally, usually the same day. Physicians can order tests and inquire about results from their private offices or homes. Special programs assure maximum privacy of the stored information. Also, doctors can review updated, printed reports which cover an entire week's laboratory work for each patient. The three hospitals contain 970 beds, and care for more than 100,000 patients annually.

For more information contact Dr. A. E. Rappoport, Youngstown Hospital Association, Youngstown, Ohio 44501.

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THE HUMAN SIDE OF AUTOMATING

By Roy G. Saltman
Institute for Computer Sciences and Technology
National Bureau of Standards

(Paper read at the 13th Annual Technical Symposium at the National Bureau of Standards, June 20, 1974)

ABSTRACT

The process of designing and installing an automated system must consider problems of human relations. If the automation will affect the operation of diverse groups within an organization, then the legitimate and conflicting interests of these groups must be recognized, and their cooperation achieved through compromise. Successful automation must include the establishment of a new network of human communications.

The effect of the automation should not be to eliminate or downgrade jobs, but to enrich or increase responsibilities, leaving the repetitive, tedious jobs to the machines. Specialists in job design should be included on the automation team.

Well-designed automation should integrate diverse groups in an organization through improved data flow, but may divorce outside data users completely if their needs are not considered in the design process. An ombudsman with the responsibility of correcting design errors to satisfy outside users' requirements should be provided.

TRADITIONAL PROJECT MANAGEMENT

To many installers of data processing and information handling equipment, the procedures for automating any organizational function are solely technical. The typical technical steps for management of a developmental project can be found in any one of a number of management guides (1), in much elaborated but similar form. The essential steps might be these:

(continued at top of page)

1. Problem definition
2. Feasibility study
3. Project planning
4. System design
5. System development and/or purchase
6. Installation of the system
7. System evaluation

These steps appeal to the technically-minded because they are rational, logical, and reasonable. Anyone proposing to automate must pursue approximately these steps in approximately this sequence. The steps are nothing more than an elaboration of that old guide to management: "plan your work, then work your plan."

AUTOMATION AND COOPERATION

However, management is more than applying a sequence of steps to the performance of tasks, just as an organization is more than a set of boxes and arrows on a wall chart. An organization is a network of people cooperating in a joint enterprise and one important management function is the process of maximizing that cooperation. If automation is selected as an activity to be pursued in support of overall organizational

(see HUMAN SIDE on page 3)

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Please submit address changes to Ms. Karen Scarlett Dental Data Center, School of Dentistry, University of North Carolina, Chapel Hill, North Carolina 27514

CYBERLETTERS

Dear Dr. Crandell:

I am writing in response to your editorial on "The Future of Cyberdent." There is no doubt that exchange of information on automation in dental education needs to be pursued vigorously. I am opposed to petitioning for SIC , but I do have an alternative suggestion.

First, (with ACM) I believe we should use SIGBIO for our own benefit as a source of information. ACM is too vast for a group with such small numbers as ours would have to function effectively and meaningfully. It would not benefit us to have access as a SIC or SIG to the might of ACM .

Rather our interest should be to foster the intelligent use of computers in dental education. As such we should form an active section within the American Association for Dental Schools. Such a group would have immediate access to the mailing lists and attention of the peoples with whom we must work to promote automation: dental school faculty and administration.

I would be most willing to work to form such a group in the national organization. In addition, I feel it is time we began discussion of the ways and means of establishing a Southeastern Region Consortium for Computer Utilization in Dental Education. After an initial exchange of progress information, we may want to consider, for instance, a Dental School Network in the Southeast.

We will soon be sending you some material on our installation for Cyberdent. I am looking forward to hearing from you regarding the above recommendations.

Sincerely yours,

Karen A. Duncan, Ph.D.
Assistant Professor
Director, Office of Computer Resources
Medical University of South Carolina

Future of CYBERDENT-Results of Survey

Responses : 17 out of a circulation of 407, or 4 per cent.

Responses to Questions :

1. CYBERDENT is a useful publication that should be continued after AFDE support.
YES -17; NO -0

2. If I had to pay for a subscription, I would be willing to pay: Range-$2 to $25

3. I am a member of: ACM -3; ORSA -0; TIMS -0; DPMA -1; ADA -6; AADS -11

Other: ADCIS -2; AERA -2; AAAS -2; IADR -2; ACFD -1; CDA -1; VA -1; AADPA -1

4. I am a full member of the Association for Computing Machinery and will sign a petition to form a Special Interest Committee/Group for dentistry.
YES -3; NO -4

5. Comments:

a. One ACM member suggest organizing under SIGBIO rather than forming another group.

B. One letter is published elsewhere in this issue.

(more HUMAN SIDE, from page 1)

goals, then more than the sequence of technical steps will need to be undertaken in order to insure success of the project. Automation will cause changes in individual duties, as well as in the network of cooperating relationships that make an organization function. The possiblity of these changes will bring to the surface the conflicts among people and subdivisions that good management will have previously resolved; or at least will have kept submerged by direction of its employees' attention to more fruitful goals. Thus, automating any significant activity should be seen by management, not only as a technnical process, but as an eminently political one: as a problem in conflict resolution and the insuring of cooperation among diverse interests.

LEGITIMATE CONFLICT

It must be first recognized that within any organization, diverse interests and legitimate conflict exist. The very nature of an organization established to pursue a general goal is such that differentiated subdivisions, each having its own subgoals and functions, are created(2). Each subdivision has its own way of viewing the world and its own way of responding to the environment in light of its particular mission and the professional personalities of those who work for it.

When automation of information flow is proposed to further the goals of an organization , however, these differences may be further exacerbated.

Cooperation will hopefully result from the faster and more precise data communications which the automated information system is to provide. However, no machine or machine-based system can enforce cooperation in a voluntary society.

Thus, an expanding data processing function in an organization, particularly if it attempts to develop an integrating "management information system" may be the focus of internal conflict among operating units.

The role of conflict mediator is not one which is expected to be assigned to data processing, nor one which it is prepared in general to accept, either because of its lack of pertinent competencies or its lack of authority within the organization to settle major differences. In many cases, the conflict may be papered over (3), because the users cannot confront their real differences when the subject of their discussions is to be the technical one of data processing. Thus, it is not surprising that many management information systems fail to achieve the broad organizational integration for which they were intended and that the data processing function is blamed for the failure. Therefore, data processing people should understand not only the technical aspects of system design, but the human relationships of the users in order to insure the success of multi-user projects.

ACHIEVING COOPERATION

The major strategy that can be employed by data processing people to maximize cooperation is user participation. It should not be assumed that simply because top management has mandated an automated system, if that is the case, cooperation will be automatically forthcoming. In that case, resistance may be passive and may be signified by delaying tactics and the withholding of necessary information. In many cases, a climate of agreement must be arduously built and the individual interests of the users recognized. Users will only cooperate fully if they believe that their own internal communication paths and means of achieving their own internal cooperation will not be upset and destroyed by new ways of doing things. Full user participation in every phase of system design, development, and installation may be the only way of assuring users that their autonomy is not being attacked (4).

There is, of course, another way to approach the problem of job changes. The need to automate provides an opportunity for job enrichment and promotion which may not exist at any other time (5). Operating organizations to be automated should be approached in this manner. The advantage of automation is that it can be employed in such a way that it will eliminate the most tedious, repetitive tasks and provide those formerly engaged in these with opportunities for more vital, more challenging work.

If the super-automators get their wish, they may be sorry in the long run. Few workers enjoy being an appendage to a machine, and the result may be mistakes, slowdowns, sloppy maintenance, absenteeism, and sabotage. However, if a proper balance between manual operation and machine operation is struck such that the inductive, experiential, special-case and non-repetitive tasks are left to people, automation will more likely achieve its goals.

AUTONOMY

A key word for the worker is "autonomy." In an autonomous situation, the worker can use his experience and developed operating knowledge to control the machine in its performance. At the other extreme, on a highly-automated assembly line, for example, the worker may feel like a "cog-in-a-wheel," being forced to take instructions from a machine and to respond to it according to its needs, without being able to employ his capabilities which only a human being can possess.

INSTALLATION

Besides problems of design cooperation and job alteration, those concerned with automation must consider the problem of

(see HUMAN SIDE, page 4)

MEDICAL CONSULTATION VIA COMPUTER

by Howard L. Bleich, M.D.

(Paper read at the 13th Annual Technical Symposium at the National Bureau of Standards, June 20, 1974.)

ABSTRACT

A computer program has been developed to assist the physician in managing patients with disorders of body fluids and electrolytes. The program directs a dialogue during which the user communicates with the computer and supplies whatever clinical and laboratory information is available. Based on the abnormalities presented, the program asks further questions as needed to characterize the fluid and electrolyte disturbances; it then produces an evaluation note of from four words to three pages, depending on the complexity of the abnormalities detected and the completeness of the information available. When appropriate, the evaluation note includes an explanation of the pathophysiology, a list of diagnostic possibilities, general and specific therapeutic recommendations, precautionary measures required by the illness or treatment, suggestions for additional laboratory studies and references to the medical literature. The time required to enter the data and to obtain the evaluation note is approximately seven minutes; the cost is considered reasonable when compared with the usefulness of the information provided.

A time-shared computer has been programmed to assist the physician in the evaluation of body fluid and electrolyte disturbances (1,2,3). The program accepts clinical and

(see MEDICAL CONSULTATION, page 5)

(more HUMAN SIDE, from page 3)

installation and conversion to the new system. If it is kept in mind that any system, particularly an automated one, still consists of a "network of cooperating human relationships," this conversion process will be eased (6).

However, if the users have participated in the design, and furthermore, if the installation of the automated system will result in new jobs that are increased in responsiblility, one can be nearly assured that the users will see to it that the presence of bugs in the new system will not prevent its ultimate adoption. They, the users, will then have a stake in the new system.

SYSTEM IMPACT ON OUTSIDERS

However, the effect on an outsider, that is, a person or group who uses the system's data but has not been a party to the design and installation, may be total alienation. Suddenly, he is receiving data in a different format; or possibly he is receiving different data completely; or the same data at a new repetition rate; or the same data referenced to a different baseline; and he has not been consulted.

Furthermore, since communications paths have altered, he may know of no way to indicate his unhappiness and no way to obtain redress. Actually, there may be extreme difficulty in correcting the situation because the anonymity of the sources of data and the complexity of its collection and manipulation created by computer processing are a barrier to the identification of decision-makers who can cause change.

THE BOUNDARY PROBLEM

The problem here is that the system designers have not expanded their horizons and their understanding of the system boundaries to consider all the users.

It may be this problem that has incensed certain holders of credit cards who have found it nearly impossible to deal with the automated systems of the credit companies and department stores. The problem is further compounded by the apparent difficulty of changing an automated system once it has been established. An individual error may be corrected, but the same kind of error may occur again and again because the outsider's basic interests were not considered in the initial design and he has no internal supporter to enforce a permanent design change.

The answer to this problem would seem to fall in the realm of establishing an outside user's ombudsman or champion on the system design team.

SUMMARY

In summary, the process of designing and installing an automated system must consider problems of human relations. The achievement of mutual cooperation, the design of systems with the outside user in mind are facets of automation rarely described and discussed in guides to project management. Design teams need specialists in job design, and an ombudsman for the needs of outside users of data systems.

On the other hand, in the literature of "organization development" which concerns the psychological aspects of management, the concentration is on human relations, but not on automation. It is hoped that this discussion has helped bridge the interdisciplinary gap between the technical orientation and the human orientation, and has been beneficial to both sides.

(more MEDICAL CONSULTATION, from page 4)

laboratory data and generates in return an evaluation note designed to review the pathophysiology of the disorders with the physician and to assist him in their management. The purpose of the program is to provide the physician with on-the-job education in a form considered to be useful in solving selected clinical problems.

The program is written in the MIIS dialect of MUMPS , a string-manipulating interpretive language that runs on a PDP-15 computer and the other containing a bank of English text. The instructions collect input data, perform calculations and select and arrange appropriate text strings that are then interleaved with excerpts from the patient's data and printed in the form of an evaluation note.

Distributed throughout the text are inserts that permit the program to modify the evaluation note for a particular patient. Insertion of given or calculated numbers permits adjustments of dosages. Insertion of words such as "relatively" and "probably" shades the meaning of borderline conclusions; other insertions may substantially alter or completely reverse the meaning of the text string. The purpose of the program is to act as a personalized textbook that presents to the physician only those excerpts from the medical literature that pertain to his patient, and to potentiate the usefulness of this information by interleaving it with given or derived information from the data base.

When the terminal is activated and the program is called, the computer transmits "elecyrolyte and acid-base evaluation," the date and the time; it then asks for the serum electrolytes in mEq/L. After typing "Na=" the computer pauses while the user makes a response. If he knows the serum sodium concentration, he types the number and then pushes an enter button, whereupon the program advances to a request for the potassium concentration. If he does not know the potassium concentration, the user pushes only the enter button. If he makes a mistake in typing the value, he can erase with a rub-out button. If he gives a value that is clearly incompatible with life, the program will ignore it and repeat its request.

When sufficient information has been provided, the program computes the concentration of unmeasured anions, defined as the sum of the concentrations of sodium and potassium, minus those of chloride and total carbon dioxide content. If the anion gap is too small, a polite comment calls attention to the incompatibility and requests the electrolytes again. If the anion gap is acceptable, the program proceeds. If blood pH is provided, pH, carbon dioxide content and a form of the Henderson-Hasselbalch Equation are used to calculate the partial pressure of carbon dioxide. If the user enters a value that is not in close agreement with this calculated value, the program makes an explanatory comment and asks for resolution of the discrepancy. If, on the other hand, he presses only the enter button, which would indicate that he has not measured carbon dioxide pressure, the computer uses the space to print its calculated value.

The program then characterizes the type and severity of each component of the electrolyte and acid-base disorder. It then asks questions concerning renal function and extracellular fluid volume and whatever additional questions are needed to determine proper therapy. As soon as its demands have been met, the program prints its analysis. The evaluation begins by defining the components of the electrolyte and acid-base disorders. It then provides a list of diagnostic possibilities, a brief discussion of suggested therapeutic measures and a small number of pertinent references to the medical literature.

In its present form, the program processes data concerning any combination of electrolyte and acid-base disorders. The data can be presented spontaneously in any order desired, or each piece of information can be entered when requested by the program. In either case, the data is checked for evidence of internal inconsistency, and additional information is requested as needed to solve the electrolyte and acid-base aspects of the clinical problem. If certain requested data are not available, the program is designed to draw the most useful conclusions possible from the data provided, to specify the limitations that pertain to these conclusions, to suggest diagnostic tests designed to circumvent these limitations, and, while awaiting the results, to suggest interim therapeutic measures. The time required to use the program at 110 BAUD is approximately seven minutes.

Experience in our hospital reveals a number of cases in which patient care has been favorably influenced by this program. On one occasion, physicians had decided to administer hypertonic saline to a hyponatremic patient when advised by the program to restrict fluids instead. Consultation was requested, and the latter course adopted. The kidney service has received numerous consultations after the program revealed a problem not previously appreciated by the physicians. At times, the program outperforms its inventor; it was, after all, written during lucid intervals, while relevant literature was at hand and more knowledgeable physicians nearby.

The generation and continual revision of such a program demands that the actual process of clinical decision making be formulated with utmost precision. Such a precise formulation requires that the investigator clearly distinguish what is known from what is assumed; it thus serves as a stimulus for study of additional areas where clinical or laboratory research should be done. Finally, this program was

(see MEDICAL CONSULTATION, page 6)

OVERVIEW OF CAI AT OHIO STATE

by Ruann Pengov

The College of Medicine's computer assisted instruction (CAI) efforts have been concentrated in three major areas.

1. CAI as a supplemental teaching tool for use in connection with on-going courses in the curriculums for medicine, nursing, and allied medical professions.
2. CAI as a tool for providing continuing medical education for health professionals.
3. CAI as a tool for facilitating the independent study concept at the curriculum level in the teaching of basic science concepts to medical students.

The fruits of these efforts have been shared with other universities and medical schools. Currently the University of Virginia is linked to the system and many other schools have implemented these materials on their own system, facilitated by the release policy. In addition, the college maintains one of two host computer systems linked to a Nationwide CAI Network for medical education. This effort is sponsored the Lister Hill National Center for Biomedical Communications, National Library of Medicine.

CAI FOR SUPPLEMENTAL TEACHING

Since 1964, the college has been continuously re-evaluating and revising its medical education curriculum. Initial experience with independent study was acquired through the use of a two-track curriculum in Anatomy and independent study groups in Biochemistry. The college has utilized CAI since 1967, when CAI courses in Anatomy and Biochemistry were written to compliment the independent study effort. Originally these courses were used by students as self-evaluation exercises. In Histology, a simulated laboratory experience on the CAI terminal has replaced the laboratory in organ identification. CAI courses have since been written in Musculoskeletal System, Physiology, Neuroanatomy, and Neuromuscular Morphology.

In the School of Nursing, CAI is used primarily by undergraduates for primary learning, for review, and for optional learning opportunities in conjunction with established nursing courses.

In the School of Allied Medical Professions, CAI is used as a simulated laboratory experience for review and self-evaluation. Fourteen CAI courses are required for student usage in the allied curriculum.

In addition, the college software, hardware, and personnel have been used in the past to support CAI developments in this category for the Colleges of Dentistry, Pharmacy and Optometry. The College of Optometry continues to utilize the College of Medicine CAI System while Dentistry uses main campus CAI and Pharmacy has its own CAI System.

CAI FOR PROVIDING CONTINUING EDUCATION

The CAI Regional Education Network (CAI-REN) is a statewide network of CAI installations. Participation on the network provides health institutions with readily available, individualized instructional materials for continuing education, planned curricula and inservice education.

CAIREN utilizes telephone lines to connect remote computer terminals to the computer at the College of Medicine on a 'round-the-clock' basis. CAIREN provides new programs on a regular basis with periodic revision and updating of materials. Audio-visuals in the form of slides, audio-tapes and printed materials are incorporated to provide a complete learning environment.

Selected programs are approved by various professional societies for continuing education credit, including the Ohio Osteopathic Association, the American Medical Association, the State of Ohio Board of Pharmacy, and the Ohio Council on Medical Technology.

This membership supported network consists of institutions of varying sizes representative of many geographic areas. Currently there are fifteen participating institutions. (see OHIO STATE, page 7)

(more MEDICAL CONSULTATION, from page 5)

developed not to circumvent the thoughtful clinician, but rather to provide the student, house officer and practicing physician with a source of continual and stimulating instruction. The purpose has been to develop an educational tool, one which is as reliable as it is indefatigable, and which is particularly effective because it relates what it teaches to a current clinical problem.

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From the Department of Medicine, Harvard Medical School at the Beth Israel Hospital, Boston, Mass. 02215

(more OHIO STATE, from page 6)

CAI FOR INDEPENDENT STUDY

The independent study program, (ISP), (3) was formerly known as the Pilot Medical School (PMS). PMS was a research project investigating the effectiveness and efficiency of utilizing independent study for medical student education. The charge which confronted PMS was to design, implement and evaluate a preclerkship curriculum that would incorporate as its foundation certain educational principles and tenets of independent study supported by a three-year grant from the U. S. Public Health Service, Division of Physician Manpower. The grant provided for one year of program development followed by two years of operation and evaluation (June 1969 through June 1972) and the first class of thirty-two students began their medical studies under this independent study curriculum in July of 1970. The second class of 59 students began in July of 1971 and a third class of 64 students began in July of 1972. In 1972, the ISP became a college supported curricular offering. Thus, medical students could elect this method of study for all their preclerkship education.

The Lecture-Discussion Program is a four-phase, three year (35 month) curriculum. The ISP is a non-lecture, student self-paced program for the basic science study, and is followed by 18 months of clinical rotations.

The Independent Study Program encompasses a spectrum of individual interpretation and operational structure; it does not employ computer-assisted instruction (CAI) in a primary instructional role. The student's use of the computer is for tutorial self-evaluation; hence, the self-evaluation exercises were designed to provide the student an opportunity to gauge his progress and determine his success in satisfying the objectives of the unit. A Tutorial Self-Evaluation (TES) Program is available for each instructional unit (submodule), designed to test comprehension of the instructional objectives. Items in the exercises may be constructed as response, true-false, multiple choice, matching or ranking questions. The computer encounters the student with a question and then immediately evaluates his response. Correct answers receive a reinforcing type of feedback, while wrong answers trigger corrective feedback and another chance to respond to the question. The computer will also respond to unanticipated answers and attempt to coach the student, through a series of statements, to the correct answer. Of particular note are the different types of computer feedback provided by the author for the student's answers. The computer programs have also been designed to indicate to a student when he is not doing well on the TES . In this instance, the computer will alert him to his deficiencies with study prescriptions which may appear as an additional study assignment, a review of previously suggested materials, or a simple statement suggesting a faculty conference.

HARDWARE AND SOFTWARE

The College of Medicine has a stable system which is operational 22 hours per day. An IBM 370/158 is housed in the Hospital Computer Center. The Computer Support Personnel for CAI reside in the Division of Computing Services for medical education and research. The staff has the experience and expertise necessary to handle CAI hardware and software problems, and to modify the coursewriter package to accommodate user needs. Expertise also exists in authoring techniques, instructional programming and course development, With a National Telecommunications Network(TYMSHARE) to make the college of Medicine's CAI materials available to users across the country.

Additional expertise in strategies, design and usage of CAI exists within the Division of Research and Evaluation in medical education (com).

RECENT PROGRESS

Under a grant from the Lister Hill Center, the college has completed a link with a National Telecommunications Network (TYMSHARE) to make the college of Medicine's CAI materials available to users across the country. There are now 59 institutions in the United States using the Ohio State University College of Medicine CAI materials on a regular basis. Through this grant, (1) the University of Illinois "case" materials (which simulate the clinical encounter) have been loaded on the Ohio State University College of Medicine System for use by college personnel and network users (2) authors at other institutions (University of Washington Medical School, University of Pittsburgh and Downstate Medical School) have developed CAI materials on the Ohio State University College of Medicine System. (3) Local users have had access to the Massachusetts General Hospital CAI materials.

Under a grant from the Bureau of Human Resource Development, the college is documenting and packaging the ISP materials. These should be available to medical schools and other potential users by Fall of 1974.

To facilitate sharing and to allow installation of quieter user terminals all college CAI courseware has been converted from 100 character to 70 character lines.

CURRENT DEVELOPMENTAL EFFORTS

Under a grant from the Bureau of Human Resources Development, the college is developing curricular and TES materials to extend the ISP concept to the clinical years of medical training.

Under a grant from the Bureau of Health Resources Education awarded to the Divison of Medical Dietetics (School of Allied Medicine Professions), simulated CAI case studies of patient encounters are being developed. These materials are currently being utilized by medical dietetic students.

(more from OHIO STATE, page7)

For further information contact:

The Division of Computing Services For Medical and Research
076 Health Sciences Library
376 W. Tenth Avenue
Columbus, Ohio 43210
Phone: (614) 422-6192

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Volume 2, Number 4
Winter, 1974

INSTRUCTION INDIVIDUALIZED

TIPS For Education (Reprinted from Duke Alumni News)

The application of computer technology to the large classroom is usually designed to maximize learning efficiency. But often students despair at the dehumanized learning situation when all contact with the instructor is lost.

So a Duke University professor has devised an innovative computer program which meets head on the teaching and learning problems encountered in large lectures, and brings in the personal touch normally reserved for seminars. And if the preliminary responses from teacher and student are indicative of the program's long-term possibilities, then a major key to future educational policy-making may have been developed.

The program, called TIPS , an acronym for Teaching Information Processing System, was first implemented eight years ago when Dr. Allen C. Kelley, chairman of the Duke economics department, was teaching at the University of Wisconsin.

Distressed with the lack of feedback between student and teacher plus an increasing trend toward depersonalization in the college community, Kelley set out to provide an "individualized course of instruction", using the computer.

TIPS is now being demonstrated throughout the country, and Kelley has received "12,000 letters of correspondence" about the program within the last year.

The key to the program, Kelley enthusiastically points out, involves a systematic effort to determine where each student's learning level is at regular intervals during the term, and then tailor course material to the individual student's needs.

For the 170 freshmen in Kelley's principles of economics course, the first Duke class using TIPS , a key feature for the instruction process is the " TIPS survey." Similar to a quiz, but ungraded, the survey contains ten to twenty questions on past reading assignments and lectures, and is administered regularly.

Within minutes after the surveys are collected, Kelley's teaching assistants feed each student's answer sheet into a computer, which later issues a report on every individual. Each report offers a gauge for student progress to date and prescribes a special assignment for the upcoming course unit.

Because the surveys are able to "pin-point precisely" the students' learning levels, Kelley asserts, small group discussions with teaching assistants can be adjusted to several student's needs, or alternatively, individual tutorials may be arranged.

Further, Kelley's system provides various alternatives for fulfilling the course requirement. As an example, those students who the computer indicates are destined to make the highest class grades are given the option of foregoing exams for participation in a class debate or spending a set number of hours tutoring a less-advanced classmate. Kelley maintains these approaches offer the widest possible learning experience for all of his students.

Perhaps the most telling evidence of the program's success is revealed in recent student achievement: TIPS students have increased their achievement levels by an average of fifteen percent.

Several students in Kelley's class echo his claim about the TIPS benefit.

(see TIPS, page 3)

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Where Is CAI ?

WHERE IS CAI ? One reason for attending the recent meeting of the Association for the Development of Computer-Based Instructional Systems (ADCIS) in Charleston was to obtain a state-of-the-art appraisal of progress. One comes away from such a meeting impressed by many things.

Reports were given of tremendous successes; others qualified their success. There were even some reports of systems that failed. There were quite a few reports on what is being planned.

The demonstrations were impressive in several respects. System down-time was noticeably low. The sophistication of the visual displays was markedly improved. Even the machine-generated voice-response unit spoke with a Southern accent.

The people who are involved in CAI appear to be individuals with a high level of commitment. They speak freely and candidly about their successes and failures. Many of the people obviously have considerable administrative support and involvement. They are vulnerable to economic changes since many of their projects are on soft money.

Health Sciences In ADCIS

HEALTH SCIENCES INTEREST GROUP

Dr. William Fitzgerald chaired the meeting of this group which had papers on an administrator's viewpoint by John Sharry, Dean, College of Dental Medicine, Medical College of South Carolina, attitudes of heath sciences administrators toward cost factors relating to CAI by Mary Carter, Catholic University, Washington, a survey of CAI in the health sciences by Martin Kamp, University of California, San Francisco; Chuck Goldstein of the National Library of Medicine, and Sidney Katz of the Medical University of South Carolina.

Sharry indicated that he felt that CAI should probably be limited to elementary concepts at the present time, the computer should be used for banal tasks and that CAI should be implemented in slow and patient steps.

Carter said that in her study of administrative attitudes in medical schools she found that the faculty should be responsible for producing and updating CAI programs and that appropriate incentive would be recognition and released time. She is uncertain of the distribution and standardization of CAI programs or of its exact place in the replacement of conventional instruction.

Kamp reported that most medical CAI programs are resident at Ohio State University or at Massachusetts General Hospital. There are 44 units in dentistry as compared to 38 in 1972. These 44 units comprise 84 hours of instruction. The Health Sciences Interest Group will publish a complete catalogue of CAI programs in medicine soon at about $6.00 per copy.

Goldstein said there had been many admisitrative changes in the National Library of Medicine recently and the new staff is moving in new directions. He mentioned the cooperative study in progress between the American Association of Medical Colleges, the American Association of Dental Schools, and the National Medical Audio-Visual Center. Plans for the future include further cooperation between these agencies and the National Library of Medicine.

Katz described the multi-disciplinary experiment in shared CAI of the health sciences. He has used Lister Hill programs with junior and senior students and finds that they preferred the CASE materials from the University of Illinois, the programs form Massachusetts General Hospital, and the Ohio State University programs in that order. He feels that at this time he can say that CAI does enhance learning.

Further reports of activities at the ADCIS meeting will be reported in future issues of CYBERDENT .

New Journal In Computing

AUTOMEDICA , A New Journal

AUTOMEDICA , A journal of automation in computing in the life sciences and the medical arts is now in its second year of publication. The journal serves as a publication outlet for dentists, physicians, and others who are using automated techniques. Articles, tutorials, book reviews, short communications, descriptions of educational programs, and other items on automation and computing techniques are welcome.

The journal is published by Gordon and Breach, Science Publishers, New York, London, and Paris. The editors of AUTOMEDICA are Enoch Haga and Josep G. Llaurado. Material for publication should be submitted to Dr. Enoch Haga, 247 Edythe Street, Livermore, California, 94550.

Conference Announced

The School of Dentistry of the University of North Carolina has announced its sponsorship of the Second Conference on Comprehensive Care in Clinical Dental Education. The Conference is scheduled to be held in North Carolina late in July 1975. The University sponsored the first such Conference in June 1969, with 105 persons attending; each dental school in the United States was represented.

Since 1969, many schools have implemented programs of Comprehensive Care, with varying degrees of involvement and success. The purpose of the Second Conference is to evaluate the progress that has been made and to identify problems and solutions that have become evident.

The Second Conference will be similar in format to the First. Several dental schools will report on their experiences with implementing the Comprehensive Care Concept, then several workshop sessions will attempt to find solutions to the problems that are identified. Summary reports will conclude the three-day meeting.

The Conference is made possible by the generous support of the Procter and Gamble Company, similar to their support for the First Conference.

On the two days immediately following the Conference, the Staff of the Dental Data Center of the University of North Carolina will present a Continuing Education course, "Computer Monitoring of Dental Clinic Activities", designed for administrators and clinic directors who are interested in using automated techniques for monitoring patient care or professional activity in a clinic or group practice. The evolvement of a system from concept through design, implementation, enchancement, and maintenance will be described.

For further information about the Conference, write to Dr. Clifton E. Crandell, School of Dentistry, University of North Carolina, Chapel Hill, NC 27514, or call (919) 966-1161.

Overview - ADCIS Meeting

REPORT OF ADCIS MEETING IN CHARLESTON

The Winter Conference of the Association for the Development of Computer-Based Instructional Systems (ADCIS) was held in Charleston, South Carolina, January 28-30, 1975. Dr. Karen Duncan of the Medical University of South Carolina was the conference hostess, Dr. Ronald Christopher of Ohio State University presided, and Dr. Martin Kamp was program chairman.

Michael Allen of Control Data described PLATO and its planned implementation at Florida State, Peter Braun of IBM in Brussels described their CAI method that requires teachers and APL , Mark Forman described the Ohio CAI Regional Education Network of 21 institutions and 75 programs which is both cost-effective and self-supporting, George Hody discussed his involvement with PLATO , Martin Kamp described two CAI projects, one in pharmacology, and one in leadership for nurses, based on the PILOT system, TSO on a 360/50 with a Datapoint mini, Mark Lieblum of Katholieke University in the Netherlands talked about a system involving 11 schools with PLANIT , APL , and Coursewriter with two projects involving 13 colleges and 180 low-cost color terminals using APL and Coursewriter in both French and English, Thomas Robinson described the Montgomery County (Maryland) system involving 21 schools, Judson Spencer talked about the development and implementation of 17 programs in dentsistry using a Prime 300 mini and 40 Tektronics and Hazeltine terminals, and Kenneth Thompson discussed the 10 schools in the Florida Regional Cooperative Computing Activity which has about 400 programs.

(more TIPS, from page 1)

Andrea Segura, of Arlington, Va., says the program "structures learning a lot better. You have the feeling they want everyone to do well. You can't help but do well after everything they tell you!"

Edward D. Bafford, Jr. Of Towson, Md., stresses the feedback between the teaching assistants and himself as the course's most helpful aspect. He also lauds the TIPS survey because "it doesn't count, and it gives you a chance to learn."

Though Kelley is clearly pleased with the excitement generated from TIPS , he is quick to point out that the program is not for everyone. In fact, its use now is primarily restricted to the sciences. And it can maximize learning incorrect information as well as accurate information.

So, for the moment, Kelley is reluctant to discuss the implementation of TIPS elsewhere unless he is convinced capable teachers are fully committed to the program.

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COMPUTERS IN DENTAL RESEARCH

Computers are being used more frequently in dental research. The recent meetings of the American Association for Dental Research in New York and the International Association for Dental Research in London illustrate this observation.

A special symposium was arranged for a discussion of "Computer Applications in Orthodontics." The presentations were:

Chairman: G. F. Walker, University of Michigan, Ann Arbor

"Current Progress in Computerization of Clinical Orthodontics", R. Ricketts, University of Southern California, Los Angeles

"Applications of Simulation Techniques to Treatment Planning", C. J. Burstone, University of Connecticut, Hartford

"Computer Graphics In Longitudinal Growth Projection," C. J. Kowalski, University of Michigan, Ann Arbor

"Some Problems in Growth Prediction", L. E. Johnston, Jr., Case Western Reserve University, Cleveland, Ohio

Many researchers use computers as tools but do not mention them in the published abstracts. Others make specific reference to computers; some of the more interesting citations include:

"A Computerized Method of Forecasting Third Molar Space in the Mandibular Arch," P. K. Turley, and S. J. Chaconas, University of California, Los Angeles

"An Interactive Graphic Dental Capitation Model," M. Marcus, and D. Bleich, UCLA, Los Angeles

"Computerized System for the Evaluation of Dental Clinic Operation," D. H. Leuerett, S. L. Handelman, H. P. Iker, East Dental Center and University of Rochester,

"Prediction of Needs for Dental Restorative Treatment From Selected Parameters," S. Fleisch, F. L. Glass, and J. E. Alman, Forsyth Dental Center and Boston University, Boston

"Oral Health Status in Relation to Sociodemographic Characteristics, Behaviors and Orientation," M. K. Nikias, R. Fink, S. Shapiro, and W. A. Sollocito, Columbia University, New York.

"Laser Moire Pattern Intraoral Topography," B. Altschuler, J. Taboada, V. A. Segreto, USAF School of Aerospace Medicine, Brooks AFB, Texas.

"Reliability of Fully Adjustable Articulators Using a Computerized Analysis," D. B. Beck and F. J. Knap, U. Of the Pacific, San Francisco, and Marquette University, Milwaukee.

"A Software Support System for Computerized Clinical Electromyography," G. S. Brown, S. S. Altug, W. D. McCall, Jr, D. E. Geister, and M. M. Ash, Jr, University of Michigan, Ann Arbor

"Economic Impact of Expanded Duty Auxiliaries in a Simulated Practice," J. B. Dilworth, G. A. Overstreet, and D. W. Legler, Univrsity of Alabama, Birmingham

"Computer Simulation of Variables Influencing Productivity in Dental Practice," R. S. Mackenzie, K. E. Kilpatrick, and T. M. Kisko, University of Florida, Gainesville

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HEALTH STATUS INDICATORS FOR DENTISTRY?

Health Planners, both private (as in the Insurance Industry) and governmental (as in the Department of Health, Education, and Welfare), need more and more data of better quality to feed to their simulation and modeling systems. Operations Researchers also need these data for the proper utilization of the management skills inherent in their field. And in a similar way, health professionals need more and better data to evaluate their effectiveness.

Thus far, most of the pressure has been toward the quantification (how many did you do last month?) and qualitation (how well did you do the ones you did last month?). Resistance is strong among the health professionals. To quantification, "I'm just a number to the insurance company". As to qualitation, "Who needs PSRO?" And so it goes.

Still, present alternatives are not feasible. Our language is not sufficiently definable to be used for this purpose. Health professionals should be early to recognize this and cooperate.

CRANIOFACIAL DIAGNOSIS

By G. F. Walker and C. J. Kowalski (abstract prepared for Medinfo Conference, Stockholm, Sweden, August 5, 1974)

Little has been done in the application of discriminant function analysis to the problem of utilizing lateral skull X-ray (cephalometric) data to partition individuals with etiologically heterogeneous skull abnormalities into relatively homogeneous, clinically meaningful subgroups. The purpose of this paper is to (a) discuss the rationale behind the application of this statistical procedure in this situation (b) describe how the relevant X-ray information may be quantified, stored and retrieved, and (c) present some examples of applications of this methodology. The first example considered is that of discriminating between skeletally normal individuals and individuals presenting a prominent upper jaw (an Angle class II malocclusion). Next a group of thalassemia patients are contrasted with a group of normal individuals and, finally, the possibility of the existence of subgroups within the thalassemia sample is investigated.

EAR DEFECTS STUDIED

The nearly inaccessible inner ear and the hearing defects that originate there are being explored with the aid of a computer.

Dr. Alfred Inselberg of IBM's Scientific Center in Los Angeles is developing a series of mathematical models that describe the complex function of the cochlea--the snailshaped organ that contains the receptor cells of the brain's auditory nerve.

The models are being used in a joint study by IBM and the Ear Research Institute of Los Angeles. Of particular interest are Meniere's disease, characterized by dizziness, nausea and a ringing or buzzing noise in the ear, and presbycusis, the diminishing ability to discern highpitched sounds as a person gets older.

The cochlea is the final link in the mechanical process that begins when sound waves set the eardrum in motion. The membrane inside the cochlea is so delicate that it may be destroyed by direct experimentation. However, Dr. Inselberg formulated a mathematical model describing the cochlea function in a series of complex equations.

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COMPUTER MANAGES BLOOD BANK

A "talking computer" system will be tested this spring as a new means of improving the use of blood donated for transfusions.

Philadelphia's Penn-Jersey Regional Red Cross Blood Center has ordered a computerized system to manage its blood resources, which serve 120 hospitals in the area.

Nearly nine million pints of blood flow out of the veins of U. S. residents each year and into the blood banks operated by hospitals, private associations and the National Red Cross.

Whole blood is widely available for immediate transfusion, but it must be transfused within 21 days to be fully effective. This means a high loss of outdated blood.

Conversion of outdated blood into its components extends the usefulness of blood supplies, but time limits apply here, too. Processing of blood for plasma and gamma globulin, for example, must begin within 30 days after the blood has been donated.

Reducing these losses to the last practical drop is the goal of the computer system under development for Penn-Jersey by Computer Sciences Corporation of El Segundo, CA, under an $81,000 contract. The computer, a General Automation SPC-16 mini with a votrax voice simulator manufactured by Federal Screw Works, will replace a manual file card system.

The system will be programmed to warn both Red Cross and hospital personnel when each pint of blood approaches its expiration date. This will permit usable blood to be transferred from hospitals that make few transfusions to larger hospitals where demand is high and constant. As hospitals request new blood supplies, the computer will order out the oldest blood in inventory for shipment.

Improved management will have a major impact on the utilization of rare blood types.

A voice simulator attached to the computer will enable the machine to talk to hospital personnel, asking them to enter the information needed to complete the records on each pint of blood assigned to the hospital.

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CLINICAL PROGRAMS COMPARED

CONFERENCE IN JULY DEFINED PROBLEMS AND SOUGHT SOLUTIONS

The Second Conference on Comprehensive Care in Clinical Dental Education was held at Whispering Pines, North Carolina, July 27-30, sponsored by the School of Dentistry of the University of North Carolina and supported by the Procter & Gamble Company. The first such conference was held in 1969.

Dr. Raymond P. White, Dean of the UNC School of Dentistry, and Mr. Arnold P. Austin, Technical Manager of the Professional Services Divison of Procter & Gamble, gave the introduction and welcome to open the Conference.

KEYNOTE ADDRESS

The keynote address identified problems which have impeded the implementation of Comprehensive Care Programs since the last conference. This review was given by Dr. Clifton E. Crandell of UNC who was the Director of the Conference. Dr. Crandell identified the lack of definition as being the chief obstacle to an organized and systematic approach to the evaluation of dental practice and dental education, which results in data that is incomplete, illegible, lost, mutilated, mis-filed, or otherwise inaccesible. He stated that "the cost of keeping records in dental practice represents one-third of the overhead." He charged those at the Conference with the responsibility for reducing this cost through systematic clinical management.

Another problem identified by Dr. Crandell is the utilization of health services. He said that only 13% of dental patients respond to recall systems and only 38% of physicians' prescriptions are filled and cited examples where patients would not utilize available health services even when there were no apparent barriers to that utilization.

He urged dental administrators to seek outside help from experts in other fields in order to utilize the many useful tools that are available.

SEVEN SYSTEMS DESCRIBED BY DENTAL EDUCATORS ACROSS COUNTRY

Seven speakers from selected schools of dentistry then presented papers describing their systems of comprehensive care. Dr. Alfred K. Williams, Associate Dean at Emory University described a manual system which monitors clinical activity to his satisfaction. Dr. Ames F. Tryon of the University of Mississippi discussed the Problem Oriented Dental Record and the plans for its use in the development of this new school. The system being implemented at the University of Pennsylvania was described by Dr. Jay S. Seibert, Associate Dean for Academic Affairs. The computerized system which has been in use for the last five years at the University of California at Los Angeles was presented by Acting Clinical Director, Dr. Frida A. Xhonga. The comprehensive patient care program at the Medical College of Virginia was implemented in the Fall of 1973; this system which is also computer-based, was described by Dr. Samuel B. Russotto, Coordinator of Patient Care. Also reporting a system currently in use was Dr. Jack Vandermer of the University of Maryland. Perhaps the most sophisticated computer-based system was that reported by University of North Carolina Assistant Dean for Outpatient Services Dr. F. Webb McCracken.

ROLE OF CONSULTANTS

The reports from the seven schools were followed by "The Role of Consultants in Systems of Comprehensive Care" by Mr. Stan Cohen, Executive Vice President of Hydra Computer Corporation. Mr. Cohen suggested guidelines for selecting and working with consultants.

NEW DIRECTIONS

The first day of the Conference was concluded by a paper "New Directions for Comprehensive Care in the Future" by Dr. James W. Bawden, former Dean of UNC and Director of the first Conference. Dr. Bawden suggested

(see MORE ON CONFERENCE, p. 3)

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PUBLISH OR PERISH? FUTURE OF CYBERDENT?

For almost three years more than five hundred subscribers have been receiving Cyberdent at no cost through a grant from the American Fund for Dental Health. These funds expire December 31, 1975.

We raised the question sometime ago as to what is to happen to Cyberdent at the end of the grant period. Several suggestions were received and diligently pursued. These included affiliation with existing organizations such as the Association for Computing Machinery and its Special Interest Group on Biology (SIGBIO). It turned out that very few people in dentistry belong to ACM or any information processing organization. The Editor belongs to several and concludes that it is difficult to justify.

We checked with companies that publish journals on advertising funds alone. The market for Cyberdent seems to be very limited and this would be a marginal approach.

So the question remains -- Will Cyberdent continue to be published or will it perish? And if it is to be published after 1975, how can it be financed?

The Editor feels that Cyberdent is for the future, rather than the past or the present. The information processing needs of the dental educator and the dental practitioner will increase steadily in the future. For this reason alone, Cyberdent will continue to be published as a non-profit publication. Funding will be by subscription with supplements from the Editor. Look for the order blank in the next two issues.

Porter New Exec at AFDH

Robert L. Porter is the new executive vice president and secretary of the American Fund for Dental Health, which supports the publication of Cyberdent.

He succeeds Mark W. Bates, who returns to the Illinois Institute of Technology after 2 1/2 years at AFDH.

Porter's appointment was announced by AFDH President Donald J. Galagan, who cited the new director's extensive experience in management and administration of fund-raising agencies.

Computer Designs Dental Implants

Dr. Dale Grenoble of the University of Southern California Dental School uses a computer to measure occlusal stresses and strains.

Albert Knoell, an engineer from the Jet Propulsion Laboratory at the California Institute of Technology and Dr. Grenoble measured stress factors to modify and improve implant designs which were tested first in animals and then in human volunteers.

An implant operation can be performed in about a half-hour After the gingiva and bone heal, the carbon rod is held in place, a stainless steel post is anchored to the rod and the dental crown is cemented to the steel.

Health Communication Satellite

A collaboration between the Canadian and United States Governments will result in the launching of a Communications Technology Satellite (CTS) in December 1975. After several months of testing and adjustments, this satellite will be available three days each week to each country for the experimental application to variety of communications problems. The Lister Hill National Center for Biomedical Communications of the National Library of Medicine has tentatively requested nine hours per week for health-related applications of the communications system.

The satellite will be capable of blanketing the entire continental United States from its stationary position over the equator. The satellite will permit bidirectional audiovisual connections between ground terminals. The Lister Hill Center plans to install several stationary ground stations at hospitals and other appropriate facilities, and to install at least one mobile station in a van. From these ground stations it will be possible to interconnect with surface communications systems permitting expansion of the total audience.

The possible applications to the health care area are many. Persumably, the satellite could be utilized to effect computer-to-computer exchange of research data and other health care information. Other applications might include remote professional consultation, EKG waveform telemetry and teleconferencing.

Initially, all applications on the system will be considered as being experimental and evaluation of the effectiveness, efficiency and cost-effectiveness of the system as compared to alternative communications mechanisms will be thoroughly evaluated.

Planning for utilization of the system is currently in progress. For additional information, contact: Mr. Earl Henderson, Chief, Communications Engineering Branch, Lister Hill National Center for Biomedical Communications, National Library of Medicine, Bethesda, Maryland 20014.

MORE ON CONFERENCE (from p. 1)

improving evaluation of patient and student progress with automated techniques as a focus for future activity. He also suggested that modern management techniques need to be employed in dental education and dental practice.

WORKSHOP SESSIONS

On the second day of the Conference, workshops met to seek solutions to previously identified problems:

(1) Evaluation of Students, led by Dr. William C. Dew of Ohio State University and coordinated by Dr. H. Garland Hershey of UNC

(2) Monitoring Patient and Student Progress, led by Dr. Roy T. Durocher of the University of Pittsburgh and coordinated by Dr. F. Webb McCracken of UNC

(3) Treatment Planning, led by Dr. William K. Collett of the University of Florida and coordinated by Dr. James W. Bawden of UNC

(4) Clinical Management, led by Dr. Kendrick Brookreson of Temple University and coordinated by Dr. Raymond P. White of UNC

(5) Production and Development in Clinical Management, led by Dr. Neill Luebke of the University of Iowa and coordinated by Mr. Fred C. Tarbox of Hydra Computer Corporation

(6) Health Status Indicators, led by Dr. Robert M. Sommerfield of Loyola University and coordinated by Dr. Clifton E. Crandell of UNC

These workshops were unique in that there was student participation and the format used was that of Participative Management, a subset of Management by Objectives.

WORKSHOP REPORTS

The third day consisted of the workshop leaders reading their section reports. Although there was much disagreement and lack of definition, the reports documented many areas of common concern and consensus on solutions. Dr. Bennie D. Barker of UNC presided over the final session.

The Conference was closed by Dr. White who stated, "There is clear recognition that clinical management forms an important aspect of today's dental school operation. ... We have no choice but to use the best management methods available to us... ."

The student representatives included Carole Pratt, Editor of Dental Student News, Susan Duncan, Editor of Bits and Burs, student newspaper at UNC, Bill Connor, UNC's ASDA Delegate, Gordon Jones, ASDA National Consultant on Military Affairs, Dana Carlton, ASDA National Consultant on Insurance, and Bill Vann, AADS Student Executive Committee Member.

Proceedings of the Conference will be sent to each participant, each dental dean, each dental student body president, libraries at dental schools, and other selected agencies. Others may obtain the proceedings by sending US $2.00 to cover mailing and handling costs to the Dental Data Center, School of Dentistry, University of North Carolina, Chapel Hill, North Carolina, 27514.

A two-day continuing education course "Computer Monitoring of Dental Clinic Activities" was sponsored by the UNC School of Dentistry immediately after the Conference on July 30-31. The attendance of 31 persons indicates considerable interest in this area.

Patient Care Faster Now

Lake View Memorial Hospital is currently using a new, advanced and sophisticated computer system designed to speed patient care procedures and achieve better financial control.

The Danville, Illinois, hospital is the first in the nation to operate the system developed by MCAUTO, a leader in hospital shared computer services.

Cathode ray tube (CRT) terminals, installed throughout the facilities, are connected to a mini-computer in the hospital to provide instantaneous communication for a wide variety of applications.

Donald L. Van Pelt, acting administrator of Lake View Memorial Hospital, described the system as "the most advanced computerized hospital data collection method available to the health care industry. It has improved communications between departments and speeds the handling of service orders so our staff can devote more time to patient care, rather than paperwork."

The new system eliminates many manual procedures by allowing staff members to enter information through a typewriter-like keyboard on a terminal, and the appropriate charges are automatically recorded. This information immediately appears on a CRT and is transmitted via telephone lines from the Danville hospital's mini-computer to a large-scale "host" computer at MCAUTO's Peoria hospital shared computer center where the information is used by another system called Hospital Financial Control System. This system automates all accounting and financial management functions.

PILOT INSTALLATION

Lake View Memorial Hospital served as the "pilot" installation for MCAUTO during the development of the new system, called Hospital Data Collection System. It has been operational since early May.

Terminals are installed throughout the Hospital. At the admitting and emergency stations, for instance, a patient is registered quickly and orders are immediately transmitted to the appropriate departments, such as the nursing station and pharmacy, so that the correct and necessary services can be prepared prior to the patient's arrival at the room.

Conversational Data Entry

The mini-computer is programmed to assist hospital personnel to enter correct data through the use of a back-and-forth "conversation." The new visual display techniques on the CRTs enable the operators to see the information as they enter it, and the computer then indicates what data should be entered next by displaying a reference list from which to select the following step.

For example, if a patient is to be moved to radiology for an X-ray, the computer responds by listing on the screen the options to be selected, such as the need for a stretcher or wheel chair. The terminal operator's selection is instantaneously transmitted and printed on paper at the radiology department and nursing station to speed the service and eliminate possible misinterpretations.

The 232-bed hospital, chartered in 1892 and nationally known for its innovative services, serves the Danville metropolitan area having a population of over 95,000. A new emergency and outpatient laboratory, currently under construction, will add 30,000 square feet of facilities to the hospital.

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Medical Writers Meet

Philadelphia -- The law and medicine, the copyright law controversy and a medical backgrounders program are among highlights of the 1975 annual meeting of the American Medical Writers Association to be held October 1 through 4 in the Marriott Hotel in Philadelphia.

Overall, the 1975 AMWA annual meeting will feature 38 workshops, and seminars, an expanded film festival, daily social functions, tours of historic Philadelphia and the annual business meeting of the Association, according to Robert F. Orsetti of Summit, N.J., general chairman for the convention.

AMWA is an international society whose members are engaged in all media of communication in medicine and its allied professions. Founded in 1940 with a membership of 27, AMWA was incorporated as a non-profit educational organization in 1951 and became affiliated with the American Association for the Advancement of Science in 1952. Today, with a membership in the thousands, AMWA is the largest association dedicated to the advancement and improvement of medical communicatio

For further information on the meeting place contact the AMWA National Office, 9650 Rockville Pike, Bethesda, Maryland 20014, (301) 530-5638.

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MINNESOTA CHART SYSTEM WORKS

The School of Dentistry of the University of Minnesota in Minneapolis has a unique computer-based Chart Requisition System. The system is designed to perform several functions and does so to the satisfaction of the users, according to Dr. Carl L. Bandt, Systems Director.

A single input document, the "Chart Request" is completed by the student whenever a chart is needed. The 95 x 140 mm card has spaces for the chart number, patient name, day of the week, date, time, floor, bay cubicle, procedure, student name, student ID number, kits, and instructor number.

The form is a 3-part (no carbon required) form with each part being a different color.

One part of the form may be given to the patient as a reminder of their appointment. Another part goes to the department in which the student will be working on the date of the appointment. The department may use the form for their own purposes such as keeping attendance or reporting student evaluation or procedures accomplished. The other part of the form goes to the keypunch service where it is prepared for input to the computer system.

The computer prints a list of student appointments for the various clinics so that appropriate supplies and equipment may be requisitioned in preparation for the student's arrival. The computer also prints an image of the requisition which is filed with the out file in the chart room as a means of locating missing charts.

One copy of the input form is turned around at the time of the clinical appointment and informs the system as to cancelled and broken appointments.

Clinical administrators receive reports "Patient List for Student" which shows patient name, address, phone number, date assigned, and their clinical needs broken down into five categories: crown and bridge, endodontics, operative dentistry, periodontics, and prosthodontics. Each of the five categories of clinical units are → broken down into individual units such as amalgam restorations or partial dentures. Totals for the student's family of patients appear at the end of the report along with a delineation of deficiencies.

The system assists the School in conducting its comprehensive care program which is under the direction of Dr. Anna P. Hampel. Dr. Hampel regards the system as a definite asset in assuring a balanced experience among students. This opinion was also shared by the clinical director, Dr. Joyce LeFevbre. Mr. Bob Jarvis wrote the computer programs.

An outstanding adjunct to the system is the mechanized chart retrieval system which enables the rapid location of more than 50,000 active charts.

Further information can be obtained by writing to Dr. Bandt.

PLAN WORLDWIDE INFORMATION SYSTEM

The International Tele-Health Communications Planning Committee, originally organized at the Medical University of South Carolina, has developed a proposal for a worldwide Health Information System. The proposal will be presented in May 1976 at a conference sponsored by the United Nations.

The plan includes proposals for using existing communications satellites for two-way exchange of information around the world. The knowledge now available in university settings would be accessible in remote areas.

The relationship between this plan and a recent announcement of the planned December 1975 launching of a Health Communications Satellite is not clear.

The scope of the health information to be transmitted is evolving, but presumably does not exclude dentistry.

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MARSHALL MCLUHAN SAID ...

Marshall McLuhan said, in Understanding Media, the Extensions of Man, "The phonetic alphabet is a unique technology. ... The phonetically written word sacrifices worlds of meaning and perception that were secured by forms like the hieroglyph and the Chinese ideogram. These culturally richer forms of writing, however, offered men no means of sudden transfer from the magically discontinuous and traditional world of the tribal word into the cool and uniform visual medium."

Relating this statement to one of the problems in the processing of information in dentistry today, it seems that dentists use ideograms to "chart the mouth". All dentists have a different set of ideograms. This blocks the sudden transfer of information between different huts of the "cottage industry" or tribes. The similarity to our problems with insurance claims is striking.

Stephen Mele, D.D.S. Oakbrook, Illinois

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COMPUTER CONTROLS X-RAY MACHINE

At the Mayo Clinic and about two dozen other institutions in the United States, a new type of medical x-ray machine is being tested. The device is called a body scanner and is based on computed axial tomography (CAT). The scanner directs a thin line of x-ray photons through a narrow cross-section of the body, as contrasted with conventional x-ray machines which send a broad x-ray beam over a large area. The beam moves around the body in the same plane. A mini computer analyzes the amount of x-rays that are absorbed as they pass through the various structures. Eight tomographic "slices" only a centimeter apart may be taken in a series with less total radiation dosage than a single ordinary exposure. The slices may be displayed serially on a television screen, creating the impression of a third dimension.

CAT is more sensitive to tissue differences and makes it possible to show structures not visible with ordinary x-ray techniques. A CAT brain scan can be done in half an hour on an outpatient basis without danger or discomfort. Toronto General Hospital reports saving over two million dollars in patient costs in one year by the use of the machine.

CAT works by having a ring of instruments rotate through a half circle about the body over a period of 20 seconds. The machine is expected to revolutionize the diagnosis of many internal ailments. It is perhaps the most effective current application of mini computers in diagnostic medicine.

HEALTH SECTION MEETS IN LAS VEGAS

The Health Applications Section of the Operations Research Society of America met in Las Vegas from November 17-19, 1975 and sponsored several sessions which attracted many papers.

These sessions included Regional Health Planning, OR/MS in Hospitals, Operations Research and National Health Policy Issues, Comprehensive Health Planning, Long Term Care, Health Manpower, Quality Assurance, Health Care Quality, a panel on Health OR: A Critical Analysis Revisited, and a health-oriented Paper Fair.

Ralph E. Steuer, College of Business and Economics, University of Kentucky, and Darryl J. Mitry, Division of Health Systems Research and Development, College of Dentistry, University of Kentucky, had a paper at the Paper Fair entitled, "Group Dental Practice Simulation Studies for Evaluating the Impact of Introducing Paradental Auxiliaries."

The panel on Health OR: A Critical Analysis Revisited referred to a previous panel which met at Atlantic City in 1972 and concluded that while many reports on OR in health had been given, there was no widespread and continuous use of these new techniques in the health care industry. The most widely used OR applications were 1) diet and menu planning for hospital patients, and 2) scheduling of nurses in hospitals. The 1975 panel re-examined and updated these conclusions and discussed abortive efforts.

The session on Policy Issues dealt with the facts that OR has not been involved in integrated delivery systems or evaluation research. Reasons cited included unclear planning objectives, the primitive state of effectiveness measures, lack of identification of constraints, difficult quantification, and lack of valid data.

CYBERDENT

DENTAL INFORMATION PROCESSING NEWSLETTER

EDITOR
Clifton E. Crandell, DDS

School of Dentistry
University of North Carolina
Chapel Hill, N.C.

Dear Subscriber:

For the past three years CYBERDENT, The Newsletter of Data Processing in Dental Education, has been published quarterly with funds granted by the American Fund for Dental Health.

Beginning in February 1976, the scope of the Newsletter is being broadened to include all aspects of Information Processing in the dental profession. Operating revenue for the non-profit "new" CYBERDENT will be from subscriptions and sponsors. CYBERDENT will continue to be a quarterly newsletter, bringing you the latest news about more effective ways to deal with the "paperwork explosion," data processing, and office management -- ideas that can save you time and money -- far more than the subscription rate of US $5.00 per year.

To avoid missing a single issue, send in your subscription form today. You'll be glad you did.

Sincerely,

Clifton E. Crandell, D.D.S.
Editor, CYBERDENT

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ADA SURVEY SHOWS CHANGES IN SCHOOLS

Chicago -- In the past quarter century, and particularly within the past several years, dental school enrollments have increased dramatically, according to the American Dental Association. But for the immediate years ahead, a leveling off of enrollments is expected.

Dental schools responding to an ADA survey have projected their expected first-year enrollments for the years 1976 through 1979. The entering first-year class in 1979 is expected to total 6,040 students or about 8 per cent larger than the 1974-75 entering class. In the previous four years first-year enrollments increased 23 per cent.

The total predoctoral enrollment in all dental schools last year was 20,146, of which 5,617 were first-year students and 4,515 were graduating students.

Trends concerning dental school tuition were also brought out in a report which has been issued by the Division of Education Measurements of the ADA Council on Dental Education. The average resident tuition in public dental schools has increased 83 per cent in the past seven years from an average of $1,043 to $1,908 a year. During the same period, the average cost to the institution to educate a dental student has risen from $7,500 to $14,500 a year.

Many more minority students are studying for careers in dentistry now than five years ago. The total number of minority students has increased in the past five years from 825 to 1,823 -- a 120 per cent increase. Minority enrollments are becoming increasingly larger within each dental school class. They represented 9 per cent of the predoctoral dental enrollment in 1974-75 as compared with slightly less than 5 per cent in 1970-71.

At the same time, women dental students have increased from only 231 to 1970-71 to 1,361 in 1974-75 -- a 489 per cent increase. Women made up approximately 6 1/2 per cent of the total predoctoral dental enrollment and 11 per cent of the first-year enrollment this past year.

COMPUTER AIDS PHYSIOLOGICAL RESEARCH AT UNC

The Department of Physiology at the University of North Carolina utilizes an Evans and Sutherland three dimensional line drawing system in the collection and analysis of neurophysiological and neuroanatomical data. Three systems presently in use are described by Dr. Joseph J. Capowski.

The first is an interactive system to digitize neurophysiological action potentials. Through man-computer interaction the potential waveforms are sorted according to shape. Statistical summaries of the sorted action potentials are then displayed.

The second system is used to generate three dimensional models of neurons (nerve cells). Cell coordinates are captured by the computer directly from a microscope. The cells are displayed and the distribution of several cell features is determined.

The last system is used to generate three dimensional structures comprised of layers of tissue. Each layer is traced into the computer using an acoustic tablet. The displayed three dimensional structure aids the understanding of interlayer relationships.

COST OF BUSINESS LETTER UP TO $3.79

The cost of writing a business letter has risen 11% in the past year, jumping from $3.41 in 1974 to $3.79 in 1975. On December 28 postage goes up; the cost will be pushed to $3.82.

According to the Dartnell Institute of Business Research, the cost includes salary and materials, based on a survey that revealed that the average salary of the administrator has risen from $250 a week to $302, and the salary of the typist has risen from $136 a week to $143.

Inflation contributed a 20% increase in the cost of materials. Fixed costs such as heating, electricity, and taxes rose approximately 10%.

Mailing costs increased from 18¢ to 20¢, again reflecting increases in salary.

SHORTHAND NO LONGER REQUIRED

A recent survey shows that shorthand once mandatory for secretaries, is becoming an archaic job requirement. The survey, conducted by the International Word Processing Association, reveals that 75% of those who answered the poll do not require shorthand of applicants for jobs as correspondence secretaries in word processing systems.

Typing skills, on the other hand, was required by all of those who answered the poll. Other requirements such as language skills (spelling, punctuation, and grammar) was required by 55%.

Job requirements are changing in offices which have gone from the traditional environments to word processing systems. In word processing, secretarial duties are specialized (typing, non-typing, or both).

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(continued on p. 4)

CYBER-MEETINGS

January 6-8, 1976 - Honolulu, Hawaii
NINTH HAWAII INTERNATIONAL CONFERENCE ON SYSTEM SCIENCES. Contact: Rahul Chattergy, Department of Electrical Engineering, University of Hawaii, 2540 Dole Street, Honolulu, HI 96822.

January 20-21, 1976 - Clearwater, Florida
THIRD ANNUAL SYMPOSIUM ON COMPUTER ARCHITECTURE. Contact: Daniel P. Siewiorek, Computer Science Dept. Carnegie-Mellon University, Pittsburgh, PA 15213; 412-621-2600 X177.

February 9-11, 1976 - Colorado Springs, Colorado
SEVENTH NATIONAL HEALTH SYSTEM PRODUCTIVITY IMPROVEMENT CONFERENCE. Contact: Vinod K. Sahney, Department of Industrial Engineering and Operations Research, Wayne State University, Detroit, Michigan 48202.

February 10-12, 1976 - Anaheim, California
COMPUTER SCIENCE CONFERENCE 76. Contact: Julian Feldman, Department of Information and Computer Science, University of California, Irvine, CA 92664.

February 18-24, 1976 - Boston, Massachusetts
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Contact: AAAS, 1776 Massachusetts Avenue, N.W., Washington, D. C. 20036; 202-467-4485.

February 24-26, 1976 - San Francisco, California
COMCON SPRING 76. Contact: COMPSON Spring 76, P. O. Box 639, Sliver Springs, MD 20901.

March 4-6, 1976 - New Orleans, Louisiana
THE ACM SPECIAL INTEREST GROUPS ON MINI COMPUTERS (SIGMINI) AND PROGRAMMING LANGUAGES (SIGPLAN). Contact: Lawrence J. Schutte, Room 6B-302, Bell Telephone Laboratories, Naperville, IL 60540.

March 22-24, 1976 - Salt Lake City, Utah
CONFERENCE ON DATA: ABSTRACTION, DEFINITION, AND STRUCTURE. Contact: Elliott I. Organick, Department of Computer Science, Room 3160 Merrill Engineering Building, Salt Lake City, UT 84112.

March 22-27, 1976 - Warsaw, Poland
INTERNATIONAL CONFERENCE ON INFORMATION PROCESSING. Contact Mr. Skulski, Informatics Research and Development Centre, 104/122, Marszalkowska Street, 00-017, Warsaw, Poland.

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Volume 3, Number 4 Winter 1975

SIMULATED DENTAL DIAGNOSIS

It seems that some people have more toothaches in a week that some people have in a lifetime.

"Bill Webster" is such a simulated patient who only exists in a computer-assisted course at the University of Missouri - Kansas City.

The object is to teach students how to diagnose cause of toothache. The course contains seven cases, each simulating a patient with toothache. The toothache might be caused by a carious lesion, a nerve problem, irritation of the gingiva, or an abscess.

The cases are typical and are designed to sharpen the student's diagnostic skills. A simple toothache may have many causes, and a diagnosis requires thorough study of the patient's problems.

There are eleven other computer-assisted courses offered by the dental school, which uses eight IBM 3270 visual display stations in the instructional resources library. The courses are supplements and cover subjects ranging from biochemistry to ethics.

The computer-assisted courses help students absorb information at their own pace; the burden on the faculty is eased. The courses also help students to graduate earlier.

To study a course, students sit at a keyboard attached to the terminal. They type in the course desired and the computer displays questions and answers in response to student control. The system explains the answer and refers a student to review material if necessary.

Instructors monitor students' progress via printouts of his answers.

Courses go beyond the basics of dentistry into personnel and patient management, team practice, cost accounting, and setting up a practice.

For more information, contact Dr. Daniel Tira, Coordinator of CAI.

MULTI-LINGUAL MEDICAL HISTORY

(reprinted from Medical/Dental News, Nov. 1975)

A report from Australia describes the development of a self-administered, computer-derived, multilingual symptom history. The computer is able to acquire a patient's history in one language and print it out in another.

Numbered questions are presented in two stages. The first is a set of primary questions. From the responses to these questions is derived a detailed secondary questionnaire unique to each patient. Patients answer questions in their native language and the computer prints out an English narrative history for use by the physician.

There are certain advantages of this computer-based history apart from the translational one described. "It is standardized and comprehensive; it requires no effort by the doctor; it is economical to produce: questionnaires can be mailed; patients can complete the questionnaires at their leisure with help from relatives or friends; and coded histories stored on the computer file provide a large data base for epidemiological and clinical research." Although the printout is in English, additional programming would permit translation from one to another of the languages now used: English, German, Greek, Italian, French, and Spanish.

Some believe that increasing health-care demands will in time make changes in medical practice inevitable. Although a computer will never adequately replace dialogue between physician and patient, certain routine tasks could easily be taken over by paramedical staff and automated methods, as well as help to overcome some of the problems of a difference in language.

Re: Archives of Int. Med. 135: 612-614, 1975.

Ed. Note: although many reports of automated approaches to medical history taking have been published, this multi-lingual approach seems to be unique. Perhaps this structured attack on language translation is the only feasible method available at the moment.

cyberdent

Newsletter of Dental Data Center
School of Dentistry
University of North Carolina
Chapel Hill, North Carolina

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Submit material for publication to the Associate Editor indicated or the Editor. For matters pertaining to circulation, write to Ms. Karen Scarlett UNC School of Dentistry, Chapel Hill, N. C. 27514.

Please submit address change to Ms. Karen Scarlett Dental Data Center, School of Dentistry, University of North Carolina, Chapel Hill, N. C. 27514.

THE HIGH COST OF PAPERWORK

The total amount of money spent on health care in the United States in 1974 is said to be about 110 billion dollars. We can perhaps realistically assume that 50 per cent, or 55 billion, was spent for overhead.

It is also reported that paperwork accounts for about one-third of the overhead. And some have said that in some countries with nationalized health services, paperwork costs represent more than half of overhead. One-third of 55 billion is 18.3 billion.

In the recent advertising literature, there is a report which may at first appear to be unrelated to the cost of paperwork; a household laundry detergent was selling rather poorly until the color of the container was changed, whereupon sales increased 500 per cent.

The importance of color is just one aspect of forms design. There are many other factors that are involved in the collection and utilization of information handling in dental practice. Most of these factors seem to be ignored.

It seems feasible to reduce the cost of overhead by at least ten per cent by applying the basic principles of forms design in health industry paperwork. Ten per cent of 18.3 billion dollars is enough money to operate every dental school in the country for the next five years. What a pity to waste it.

LETTER to the EDITOR

To the Editor:

This is just a brief note to tell you that I've just seen the Summer 1975 issue of CYBERDENT. It strikes me that this represents excellent work indeed and that it deals with issues that appear to me to be crucial and pertinent to the future of dental education, not to mention dentistry per se. I'm delighted that you and your school are leading this effort.

With best regards,

Yours sincerely,
Cecil G. Sheps, M.D.
Vice Chancellor, Health Sciences
University of North Carolina at
Chapel Hill

LETTER from the EDITOR

THANKS

Judging from the feedback we have received, the publication of CYBERDENT over the past three years has been a success. We are pleased that this is the case. It is this kind of encouragement that makes ventures of this sort worthwhile for those who do the work.

This editorial is to let the readers know who did the work. It is our way of saying thanks.

Karen Scarlett has typed most of the words you have read. She has also handled the correspondence, done the keypunching, kept the computerized mailing list current, helped with layout, and secured the mailing and printing services required.

Mort Shakun has provided valuable editorial assistance in the area of Operations Research and has contributed material for publication.

Bill Fitzgerald has been our Associate Editor for CAI, and has performed in an exemplary fashion. He has also contributed material for publication.

We appreciate the help of our contributors, people like Richard Bartlett, Arnold Reisman, Kerry Kilpatrick, Michael Leonard, Richard MacKenzie, Nelson Logan, Fred Parkin Clemens Full, Timothy Smith, Joseph Tebben, Thomas Zullo, Douglas Vaughan, David Wilson, Roy Saltman, A. E. Rappoport, Howard Bleich, Ruann Pengov, G. F. Walker, C. J. Kowalski, and many others.

Financial support has come from the American Fund for Dental Health. Their "seed money" has borne fruit. Our appreciation goes to them.

Support in many ways has come from the School of Dentistry of the University of North Carolina, particularly its administration in the persons of Jim Bawden, Ray White, and Roger Barton. Their efforts to establish and perpetuate the DENTAL DATA CENTER, which has served as a necessary base of operations for CYBERDENT, are recognized as excellent examples of farsighted management.

It is our hope that the next three years of CYBERDENT will be as rewarding as the first three have been. We expect that to be the case, which prompted our decision to continue publication on a subscription basis.

HISTORY SYSTEM AT KNOXVILLE

ENGLISH OUTPUT OF AUTOMATED MEDICAL HISTORY

There is a long-term project at the University of Tennessee Memorial Research Center and Hospital in Knoxville which includes the development of a computerized medical record. Progress on this phase of the project was reported at ACM '75, the Annual Conference of the Association for Computing Machinery held October 20-22 in Minneapolis.

The physical examination part of the medical record has been automated. Using a computer terminal, a physician can input physical findings in questionnaire form. Software written in the MUMPS language encodes and compresses the inputs, then records them (unambiguously) in a tree-structured data base. The computer then generates conveniently readable output in English phrases which are rich with modifiers and descriptors.

The vocabulary of physical examinations is relatively fixed and the body topography and its abnormalities form a finite and manageable data base, making this aspect of the medical record a logical choice to automate, being much simpler than those segments that might require completely free narrative input.

The initial implementation will be in the Intensive Care Nursery under the direction of Dr. Henry Christian. It will run on a PDP-15 minicomputer with large disk storage.

The physician at the computer terminal is presented with topsites, abnormalities, and modifiers and is able to select appropriate descriptors from the menu. Twenty possible topsites (topographical sites) are displayed on a screen (CRT), such as General, Chest, Mouth, etc. The physician selects the topsite with a minimum of typing. The terminal then displays the abnormalities and modifiers for that particular topsite. The physician responds by typing codes from the menu that apply to the patient being examined.

The abnormal findings are compressed and encoded into alphanumeric strings representing hierarchial tree structures. The program may add modifiers to give more detail to the description of the abnormality.

A standard output algoritym is used since all topsites fit into similar structures. The algorithm cannot be used to produce a variety of English sentences but it functions satisfactorily for the medical examination which usually consists of a topsite followed by one or more phrases.

Semantic, syntactic, and spelling difficulties are avoided because the output is derived from stored information that is triggered by input. In addition, since the output is structured similarly each time, it is easier for the physician to scan reports of physical examinations done by other physicians.

Further information may be obtained from the proceedings of ACM '75 or by writing to Sara R. Jordan of the University of Tennessee at Knoxville; Arthur Kretchmar, University of Tennessee Memorial Research Center and Hospital (UTMRCH) at Knoxville; or to Cathy J. Kreikebaum of IBM, Knoxville.

SPEECH SYSTEM AT BIRMINGHAM

COMPUTER HELPS CORRECT SPEECH ERRORS

(reprinted from Dental Survey 51:71, Dec.'75)

Scientists at the Outpatient Clinical Research Center of the University of Alabama in Birmingham (UAB) use a new computer-based instrument system known as PAGIS to diagnose and treat speech defects as well as to study normal speech patterns.

Tiny electrodes or "beads" embedded in a thin plate are placed against the roof of the mouth to detect tongue contacts while a video-based system determines lip and jaw activities by scanning and measuring the "beads" attached to the face and one tooth. A computer takes in all the information, processes it and displays it back to a clinician or, in many instances, to the speaker himself. This feedback system may offer assistance to patients who are not helped through the traditional technics of speech therapy.

In one case, an hour's therapy using PAGIS helped a patient begin to produce a normal "s" sound by being able to see a visual display of his tongue, lip, and jaw placement. He had received other speech therapy for three years without success.

The investigators programmed the computer to display the pattern of a normal "s". As the subject spoke, lights on a display panel in front of him lit as he touched different spots on the roof of his mouth. This allowed him to see as well as feel what was happening in his mouth. He compared this pattern with waht the computer showed him to correct, and changed accordingly.

The work is under the direction of Samuel G. Fletcher, M.D., chairman of the Department of Biocommunication at UAB Medical Center, and funded by the National Institute of Neurological and Communicative Disorders and Stroke. □

OR of Unscheduled Visits

CONTROL STUDIED THROUGH DELAY RULES

Dr. Brant E. Fries of the Center for Community Health Systems at Columbia University in New York City has reported on "The Effect of Delay Rules in Controlling Unscheduled Visits to Hospitals" at the November 17-19 Joint National Meeting of the Operations Research Society of America and The Institute of Management Science in Las Vegas. The findings should be of considerable interest to dental school administrators, directors of outpatient facilities, and practitioners.

Dr. Fries simulated a model of arriving patients, some of whom could be delayed. Patients may be asked to return at an appointed time in the future, depending on congestion in the clinic at the time of their arrival. An earlier study reported that the average queue wait is significantly reduced by such a delay system.

Fixed-length clinic sessions and priority of returning patients were two of several delay rules that were compared in the study. □

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February 18-24, 1976 - Boston, Massachusetts
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Contact: AAAS, 1776 Massachusetts Avenue, N.W., Washington, D. C. 20036; 202-467-4485.

February 24-26, 1976 - San Francisco, California
COMCON SPRING 76. Contact: COMPSON Spring 76, P. O. Box 639, Sliver Springs, MD 20901.

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THE ACM SPECIAL INTEREST GROUPS ON MINI COMPUTERS (SIGMINI) AND PROGRAMMING LANGUAGES (SIGPLAN). Contact: Lawrence J. Schutte, Room 6B-302, Bell Telephone Laboratories, Naperville, IL 60540.

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CONFERENCE ON DATA: ABSTRACTION, DEFINITION, AND STRUCTURE. Contact: Elliott I. Organick, Department of Computer Science, Room 3160 Merrill Engineering Building, Salt Lake City, UT 84112.

March 22-27, 1976 - Warsaw, Poland
INTERNATIONAL CONFERENCE ON INFORMATION PROCESSING. Contact Mr. Skulski, Informatics Research and Development Centre, 104/122, Marszalkowska Street, 00-017, Warsaw, Poland.

March 31-April 2, 1976 - Philadelphia, Pennsylvania
ORSA/TIMS 1976 JOINT NATIONAL MEETING. Contact: J. J. Burbridge, Publicity Chairman, 1976 Joint ORSA/TIMS Meeting, College of Engineering, Rutgers University, New Brunswick, NJ 08903.

July 12-14, 1976 - Washington, D. C.
1976 SUMMER SIMULATION CONFERENCE. Contact: Arthur I. Rubin, Electronic Associates, Inc., West Long Branch, NJ 07764.

September 16-17, 1976 - Philadelphia, Pennsylvania
SOCIETY FOR MANAGEMENT INFORMATION SYSTEMS ANNUAL CONFERENCE. Contact: SMIS, One First National Plaza, Chicago, IL 60670.

October 20-22, 1976 - Houston, Texas
ACM 76 ANNUAL CONFERENCE. Contact: Olin Johnson, Computer Science Department, University of Houston, Houston, TX 77004.

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ENTAL INFORMATION PROCESSING NEWSLETTER

Volume 4, Number 1
Spring 1976

MUMPS, MUG PROGRESSING

UNIQUE TEXT-ORIENTED LANGUAGE AND SYSTEM

MUMPS is the acronymn for Massachusetts General Hospital Utility Multi-Programming System, a unique computer language and operating system integrated into a compact, unified package.

The MUMPS language was designed to facilitate the manipulation and creation of text-oriented, hierarchial data. For example, it is possible to examine data for keywords, letters, numbers, or other characters, both for their presence as well as their positional relationships. This is a powerful tool for editing and verifying data at the time of entry. Text material may also be divided or collated on-line.

The hierarchial file structure is a tree-like relationship between data elements such as from general to more specific. The user can design the tree to suit his own requirements. This is of particular value in medical records where there is a wide variety of importance and detail attached to different data items.

MUMPS is a high-level language in that it is oriented toward problem solving rather than hardware. The language is easy to learn although several months are usually required to appreciate the full range of options available to the programmer.

THE OPERATING SYSTEM

Although MUMPS may be implemented with other operating systems, it is usually more efficient if implemented with its own operating system. The system is capable of time-sharing between several different terminals. Also, the data bases are shared. This means that any data base can be examined or updated by any authorized user. Stored data bases can also be protected, preventing unauthorized or undesirable changes.

Since MUMPS is designed as an on-line system, the user may enter, debug, and immediately use new programs. Corrections are forced. Further, MUMPS is usually implemented as an interpreter, there is no compilation step, eliminating compilation time and storage of compiled code.

The system has been implemented on a wide variety of hardware, including B6700, HP 3000, H 635, NOVA, MODCOMP, PC-12/7, PDP-9, PDP-10, PDP-11, PDP-15, System 7, and System 360/370. It is in use in over 200 institutions in the United States, Europe, and in Japan.

(see MUMPS, page 2)

HEALTH MATERIALS COMPILED

CAI INDEX ANNOUNCED BY ADCIS

The most complete and up-to-date collection of information about computerized teaching materials in the Health Sciences has been compiled by Dr. Martin Kamp at the University of California, San Francisco. The index contains information on more than 300 instructional units or programs which have been developed at many institutions in the United States and Canada. These programs are intended for students of dentistry, nursing, medicine, pharmacy, and other health science areas. The length of the units varies from 10 minutes to 50 hours. The index covers a total of about 750 hours of teaching materials.

Information in the index includes the subject, author, institution, target group, time, computer system, etc. There are four key-word indices on subject, author, language and institution.

The indexing project was partially funded by the National Library of Medicine. Publication and distribution will be done by the Health Sciences Interest Group of the Association for the Development of Computer-based Instructional Systems (HSIG-ADCIS). ADCIS is making the index available on a non-profit basis for $4.50, which includes postage and handling. A discount of 10 per cent is available to libraries and on orders of 10 or more copies.

Orders should be sent to Dr. William Fitzgerald, HSIG Treasurer, 2114 Mason Hill Drive, Alexandria, VA 22306. Checks should be made payable to "ADCIS-HSIG".

INSTANT HOSPITAL BILL

A new billing system installed in a Lansing (MI) hospital enables handing the patient a bill before he leaves the hospital, even for a visit to the Emergency Room.

Two Hewlett-Packard 21MX Minicomputers connected to CRT terminals, tape and disk drives, a printer, and a paper tape reader comprise the hardware for the system described in Minicomputer News.

Inputs are through the CRT terminals which are located in the various departments of the hospital. Charges are entered in Radiology, Pharmacy, the labs, etc., and are collected and stored in the Emergency Room where the printer is located. When the visit is complete, the printer produces the statement of charges, and payment arrangements can be made before the patient leaves the hospital.

CYBERDENT

DENTAL INFORMATION PROCESSING NEWSLETTER

EDITOR
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School of Dentistry
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Chapel Hill, N.C.

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DENTAL DATA CENTER

(MUMPS, from page 1)

USERS GROUP

A MUMPS Users Group (MUG) has been organized to enhance the flow of information about the system. At present, there is a membership of over 200 and the mailing list includes more than 1500.

A newsletter is published quarterly to inform users of new applications, new developments, solutions to user problems, job information, book reviews, and other items of interest.

The group has also published a Summary of Applications which lists the applications by title. They are cross-referenced to institutions and the person to contact.

An annual meeting is held and the proceedings are publised. In 1975, MUG met in Washington. In addition to the regular meeting, one-day workshops were held to introduce the language to new users.

APPLICATIONS

There is a large number of existing applications, many of which are in the public domain and may be acquired at minimal expense. The applications include accounting, clinical lab, medical records, CAI, drug use and interaction, inventory, patient admitting and census, peer review and quality assurance, preventive maintenance scheduling, radiation therapy management, tumor registry, and problem-oriented records.

CONTACT

Further information my be obtained by writing to Dr. Joan Zimmerman, Biomedical Computer Laboratory, 700 South Euclid Avenue, St. Louis, MO 63110.

HEART DISEASE MONITORED

A time-sharing computer system is improving data base updating and retrieval and reducing data storage demands at Boston Children's Hospital, using dedicated minicomputers.

According to an article in Minicomputer News (2-12-76), a Prime 300 minicomputer with 64K bytes of main memory and a virtual memory disk operating system, is helping the Hospital to maintain high quality care and fight rising costs. The system also drives a card reader, printer, tape unit, and four CRT terminals.

The system provides time-sharing services for the Regional Infant Cardiac Program, involving 10 other hospitals in all six New England states. The data base contains 2800 cases of children with congenital heart disease. There is also a data base of over 12,000 cardiology patients.

Inputs enter the system through summary forms which are completed by hospital personnel. Outputs on individual patients include history, diagnosis, and a chronological list of medical events.

CORONER SPEEDS TURNAROUND

The Toxicology Laboratory of the Los Angeles County Coroner's Office has installed a Computer Automation Naked Mini-computer to assist its gas chromatograph/mass spectrograph in the analysis of tissue specimens, according to Minicomputer News (2-12-76).

The chief advantage of the system using the computer is to shorten the turnaround time of analyses. What would take days by conventional methods take only a few minutes for the computer, enabling earlier reporting on cases. In addition, the faster turnaround permits a more comprehensive examination to be performed. An analysis that previously might have been considered prohibitive may now be routine.

The computer system is more useful in connection with the mass spectrograph. This device ionizes samples, passes them through a magnetic field, measures the mass of the compounds, and feeds the information to the computer, where it is compared to known spectrograms, and a list of possible matches is printed. A complete search requires about an hour.

The system hardware includes (in addition to the 8K mini-computer) a Teletype terminal, a Tektronix oscilloscope, a Zeta plotter, and a Diablo Model 31 moving-head disk drive.

There are plans which will enable the expansion of the system to 192K bytes of memory over the short range and up to 512K and 31 users for long range.

COMPUTER AIDS IMPLANTS

A computer analysis of the stresses involved in vitreous carbon implants is helping to verify the structural integrity of designs before they are built and tested clinically. Dr. Dale Grenoble, associate professor of dentistry, and Albert Knoell, a biomechanics engineer, at the University of Southern California, have developed this new approach by building a mathematical model of carbon implant stress patterns. Too little stress or too much stress causes the bone to deteriorate. Implants have been successfully placed in over 300 patients over the past four years.

Dr. Ronald Voss is director of the clinical implementation of the project at the University.

The computer analysis was done on the University"s IBM System 370 computer.

'76 NATIONAL COMPUTER CONFERENCE SET FOR JUNE

A BIG YEAR...FOR THE NATION AND THE COMPUTER INDUSTRY

The Nation's Bicentennial Celebration will serve as a backdrop to the 1976 National Computer Conference, June 7-10, in New York. Equally important to the computer industry will be two other anniversaries -- the 25th anniversary of the electronic digital computer as a commercial reality, and the 25th anniversary of the first Joint Computer Conference, predecessor to the NCC.

The '76 NCC will set new standards of excellence. A world's fair of data processing equipment and services will be displayed on three floors of the New York Coliseum. More than 100 information-packed program sessions will address the needs of computer professionals, specialists, users, corporate managers, educators...everyone involved with data processing.

The program will cover the fundamentals of computer science and technology, data processing methods and applications, management and societal issues, international relations, and the impact of economic trends on the computer industry. In addition, there will be a variety of noteworthy events, special activities, and featured addresses by prominent spokesmen.

BIGGEST COMPUTER SHOW ON EARTH

The world's largest and most diverse lineup of important data processing equipment, systems, and services will be shown during the '76 NCC. Products dealing with virtually every aspect of data processing ...mainframes, minicomputers, peripherals, packaged programs, publications, microprocessors, memories, terminals, services, user needs, and much more...will be displayed by a wide range of companies in 90,000 square feet of exhibit space.

The more than 275 exhibiting organizations will include recognized industry leaders as well as new and emerging companies...all with their newest offerings. Among companies already signed up are such leading organizations as Ampex, Control Data, Data General, The Harris Corporation, Hewlett-Packard, IBM, ICC/Milgo, Lear Siegler, Modular Computer Systems, NCR, Pertec, Xerox, and many more. More than 1000 industry representatives will be ready to supply technical and commercial information and to assist in analyzing specific user problems.

A LANDMARK PROGRAM

The '76 NCC, under Conference Chairman Dr. Carl Hammer, will be an invaluable learning experience for everyone who uses, designs, buys, sells, or thinks about computers, data processing, information or word processing equipment, systems, and services.

"This National Computer Conference will be a landmark event in the annals of computing," notes Dr. Hammer, Director of Computer Sciences for Sperry-Univac in Washington, D. C. "Nothing less than a history-making Conference would be appropriate on 1976. The NCC Program will combine proven ideas and approaches with innovations and bright new ideas designed to make this a profitable and stimulating experience for all."

Dr. Hammer, honored as Computer Sciences Man-of-the-Year in 1973 by the Data Processing Management Association, points out that the '76 NCC Program will assist all computer users in maintaining technical competence and sustaining steady upward progress.

MORE THAN 100 SESSIONS

The Conference program will be organized into 10 or more major program areas, or "tracks," scheduled to run throughout the four-day NCC. These tracks, in turn, will include more than 20 special one-day "mini-symposia," each consisting of four sessions devoted to specific, high-interest topics...such as medicine and health care, government policy and computers, control instrumentation, banking and electronic funds transfer, business systems, performance measurement, standards, networking, privacy, legal considerations, and word processing systems.

The program tracks will cover such topics as complex systems, hardware technology, software and components, system architecture, computer communications, management concerns, education and training, advanced applications, and societal issues. In addition, plans are underway for presentation of major survey papers tracing important historical developments within the field of computing and information processing.

SPECIAL PROGRAMS AND EVENTS

Plenary Sessions, Professional Development Seminars, and additional featured events will enhance the '76 NCC Program. Plenary Sessions will cover topics of unusual interest to all data processing professionals and will feature prominent spokesmen from major business areas, such as banking and finance.

The Professional Development Seminars will provide users and members of the business community with in-depth expositions on cost-effective utilization of computer power and other advanced techniques in data processing. Each seminar will provide ample opportunity for discussion with session leaders. A separate fee will be charged for each seminar held during the Conference Week. Registration for the Professional Development Seminars will be open only to Conference registrants.

Among the featured Conference events will be a Pioneer Day Program which will honor those individuals from the Moore School of Electrical Engineering, University of Pennsylvania, whose efforts led to the development of ENIAC--the first electronic digital computer.

Deadline for advance registration ($60) is May 14, 1976, a $15 saving over on-site registration, and includes advance housing information and forms, and a copy of the Proceedings. Post-conference price for the Proceedings alone is $50.

For more information, write to:

'76 NCC
c/o AFIPS, 210 Summit Avenue
Montvale, New Jersey 07645
Telephone: 201/391-9810

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NEW PLOTTER ANNOUNCED

Calcomp (California Computer Corporation) has announced a new model plotter, the 836. The new model can produce drawings up to 34 inches by 120 feet. The standard pens are Plastip or ballpoint. Liquid ink pens are also available.

Plotting increments of 1.016 millimeters (0.004 inches) at a speed of 5.0038 centimeters (1.97 inches) are reported. The machine is a table-top model, measuring 1.2954 meters (51 inches) by 0.47625 meters (18.75 inches.

The new model is said to be much quieter than the old model 563 because DC servo motors are used to drive the drum and the carriage, and a linear motor is used to move the pen.

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CYBERDENT

DENTAL INFORMATION PROCESSING NEWSLETTER

Volume 4, Number 2
Summer 1976

BASIC FORMS DESIGN

One of the key factors in paperwork is forms design. This is true in business, government, dental education, and dental practice. Although the subject is far too extensive to discuss in detail in a short tutorial, there are some simple basic fundamentals that can be stated briefly, learned easily, and implemented quickly. The purpose of this article is to present some of the basic fundamentals.

Each form must have a name and a number. Since many names are similar, the number is necessary to assure a unique identity. Many times, the form becomes known by its number rather than its name. An example of this is the Form 1040, or federal income tax return form. Although there are many income tax forms, there is only one Form 1040. The name and the number must be placed on the form. Ordinarily, the name of the form will be placed at the top, preferably on the left. It should be large enough to be easily recognized several feet away. The number of the form is usually placed in the lower left corner with the revision date immediately following or immediately below it. The number is important for filing purposes in a forms control program as well as identity to users and printers. The revision date is suggested to prevent use of obsolete versions of forms, to provide for a systematic periodic review of forms, and to create a climate of effective management.

Forms should be self-contained and all instructions for completion, usage, filing, and printing should be on the form itself. This will eliminate the need for a "users manual" or other document that users have to refer to in order to accurately complete the form. Frequently, the instructions for completing the form do not appear on the form or in a "users manual" and this results in a high percentage of inaccurate data. Sometimes, in very complicated forms, it is impossible to place all of the instructions on the form itself. Form 1040, for example, comes with a small booklet. The government also publishes a book of detailed instructions, and many tax authorities publish books of a similar nature. Considering the vast extent of the income tax laws, however, Form 1040 is remarkably self-contained. It is extremely well-designed. It is the paying of the tax that makes it unpopular.

The design of the form should facilitate its use. The principal concern is with making entries or reading the data that has been recorded, and a thorough systems analysis should be done to determine which is more important because the design for input may conflict with the design for output. Factors that must be considered include whether entries will be typed, handwritten, or both, or mixed. Twice as much space, both vertically and horizontally, is required for handwritten entries as compared to typwritten entries.

Another design principle that relates to the ease of entering data is the format. For example, many people in the health professions feel that the most effective way to record patient findings is in a narrative form. However, systematic analysis of large collections of narrative data usually suggests a rather small number of different phrases that make up a substantial portion of the text. A form can then be developed that will provide these "stock" phrases in a series of boxes that can be checked with a phenomenal increase in both efficiency and accuracy. In such a system, there must be a provision for narrative entry as "other".

Storage of data must be considered also. The main object is to minimize the handling. A schedule of form or data retention must be developed before adequate plans can be made for storage. This should include inactive as well as active records. Likewise, the frequency of retrieval will influence the storage. Electronic and photographic processes may come into play in developing a storage plan.

The design of forms must be aimed at a personnel level consistent with the users. A patient health questionnaire aimed at a college graduate level would not be useful in a general patient population. The information required on the form must be simple enough for almost anyone to supply, usually aimed at about the eighth grade level. The instructions must be that level also. Sometimes, some principles of design must be sacrificed in order to make the form acceptable to the user initially, with the more sophisticated changes introduced later after users have used it and accepted it.

Many administrators fall short on documentation about forms and their use. Even if all the instructions necessary to complete a form are printed on the form itself, the form is usually a part of a larger paperwork system that requires documentation. The documentation should include a chart showing the flow of information through the sytem, instructions for completing the form, use of the form, the storage plan, schedule for updating, printing sources and instructions, and any other information that is pertinent.

(see FORMS DESIGN, page 3)

CYBERDENT

DENTAL INFORMATION PROCESSING NEWSLETTER

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EDITORIAL

DATA ARRANGEMENT

The arrangement of data items on a form is considered by many to be a trivial matter. Undoubtedly this is true in a few cases, but studies show that the cost in time, labor, money, and accuracy is many times the cost of the form itself. Some corporations report that the cost of processing a form may be 100 times the cost of the form.

It is extremely encouraging therefore to note that some persons associated with the dental profession are not only concerned about this problem but are doing something about it. In a recent journal article (J. Dent. Educ. 40:107-108, Feb. 1975), Eric Plow, a computer scientist, reports on the optimal arrangement of the tooth surfaces on patient forms, based on a review of almost 30,000 dental restorations. It turns out that MODFL is a reasonably optimal choice which is fortunate because that is the way most dentists are accustomed to seeing the surfaces listed. Of course, that may not be the case with many other arrangements of other data items that thousands of dental professionals deal with every day.

How much time are dentists wasting filling out forms that are poorly designed? The answer is not obvious, but the time has come to seek the answer, and then to find solutions.

"Did someone help you when you were in dental school?"

"I remember the times when people helped me. There were discouraging moments when others gave me guidance that enabled me to make it through. And there was financial help when I really needed it.

"I've never forgotten that assistance. That's why I'm involved with the AFDH campaign! It's a way of repaying some of the help I enjoyed when I needed it.

"If you feel the way I do, you can help too. Simply make a contribution to the American Fund for Dental Health! Your check will help provide scholarships for some of the country's 20,000 dental students, and it will help support the many research projects that ultimately help you practice better dentistry.

"I hope you'll send your check right now. There's really no better way of remembering the help you got when you were in dental school!"

American Fund for Dental Health
211 East Chicago Avenue Suite 1630, Chicago Illinois 60611

NETWORK DESCRIBED

By Karen A. Duncan

Computer Assisted Instruction has gained popularity in recent years as an alternative to traditional teaching methods. However, in dentistry as well as in other disciplines, increased use of this new educational tool has been curtailed by rising costs and shrinking budgets. This is especially true for persons at schools which do not already have computer facilities for instruction. In the following paragraphs an alternative to in-house computer facilities for dental education is described.

The Health Education Network, Inc., is an organization which provides computer-based educational materials for its 70 member institutions. The goals of the network are:

1. To maintain and enhance medical education through inter-institutional sharing of CAI materials.
2. To investigate academic and professional aspects of Computer Assisted Instruction such as faculty development, curriculum development, authorship, evaluation and peer review.
3. To investigate technical and functional aspects of Computer Assisted Instruction such as networking alternatives, program transfer, documentation distribution and cost-effectiveness.
4. To develop Computer Assisted Instruction into a disciplined literature.
5. To communicate with users and with medical educators in general on the status, availability and effectiveness of Computer Assisted Instruction.
6. To provide meetings for the reading and discussion of papers on Computer Assisted Instruction, to discuss policy and to disseminate knowledge.
7. To extend the means through which health professionals may continue their education.

The health sciences courseware is made available over the Tymshare computer network to CRT terminals or teletypes located at the member institutions' learning centers. The teaching programs were developed at the Ohio State University School of Medicine, Massachusetts General Hospital and the University of Illinois Medical Center, and they are presently being supplied over the Network by OSU and MGH. The wide variety of programs in basic and clinical medical sciences which are used by students in medicine, dentistry, nursing, allied health, and other related fields, as well as by faculty and staff for continuing education, provide over 400 hours of available courseware.

In addition to this courseware, there are four programs in clinical dentistry which are available over the Network. These programs provide dentists or students with practice in diagnosis and treatment planning for such problems as oral pain and oral cancer. Several other programs in clinical dentistry have been written, and could be made available to users. Schools interested in further exploration of this method of dental education should contact the Network. There are a number of alternative ways to utilize the Network in a dental curriculum. The available programs may be used or requests can be made to have additional programs available, or schools may develop their own programs to share with the Network.

Health Education Network, Inc., is a not-for-profit organization guided by a user-elected Board of Directors, and directions for growth of the Network will depend on user demand and the availability of quality courseware. The reader is invited to write the author for information about membership in the Network, any courseware that might be added, or other information about the Network. Address: Dr. Karen A. Duncan, Director, Office of Computer Resources, College of Dental Medicine, Medical University of South Carolina, 80 Barre Street, Charleston, SC 29401. Phone: (803) 792-3211.

PAPERWORK COMMISSION

The Commission on Federal Paperwork was created in 1974 by Public Law 93-556, approved December 27, 1974. The final report of the Commission is due October 3, 1977.

The Commission is charged with examining paperwork requirements and recommending changes in federal information policies and practices toward minimizing federal reporting burdens while still providing government with necessary and, where possible, better information.

The bipartisan Commission is chaired by Rep. Frank Horton of New York. Senator Thomas J. McIntyre is Co-chairman. Mark Littler, former partner, Arthur Anderson and Company, serves as Vice Chairman. Also on the Commission are: Donald C. Alexander, Commissioner of Internal Revenue; Gilbert Barrett, Commissioner of Dougherty County (Georgia); Robert Benton, Superintendent of Public Instruction (Iowa); Otis Bowen, MD, Governor of Indiana; Bill Brock, U. S. Senate; Bruce Fielding, CPA, Secretary, National Federation of Independent Business; Louis Knecht, Secretary/Treasurer, Communications Workers of America; James T. Lynn, Director, Office of Management and Budget; Esther Peterson, Vice President, Giant Food, Inc.; Elmer B. Staats, Comptroller General of the United States; and Tom Steed, U. S. House of Representatives.

Hearings have been held in Chicago, Pheonix, Atlanta, and Washington. Future hearings scheduled are: June 1-2, Bloomington/Layfayette, Indiana; June 15-16, Des Moines, Iowa; July 8-9, Oklahoma City; September 8-9, New York; October 28-29, Washington; and November 16-17, Dallas.

A savings of $270 million has already been realized from a recommendation in an interim report. Congress, acting on the recommendation, passed legislation late in 1975 which changed the filing of Schedule A of IRS Form 941 from quarterly to annually, reducing the paperwork by 24 million pages. The change is expected to save the employers $250 million annually while saving the government $20 million.

According to information compiled by the Commission, a hospital in Tennessee reports that their administrative costs to satisfy federal paperwork adds $4.00 per day to the cost of a hospital room.

The Commission is now staffing specific study groups to address areas where systems can be changed to result in less paperwork. Concerned citizens are urged to appear at the public hearings, or to write to the Commission at 1111 Twentieth Street, N.W., Washington, D. C. 20582.

CANADIAN APPLICATIONS

A comprehensive reference guide to uses and users of computers in the health field in Canada will soon be ready in its fourth edition. "Health Computer Applications in Canada" is the major publication of the Health Computer Information Bureau. The Bureau was formed in 1974 under sponsorship of the Canadian Hospital Association and the Canadian Medical Association with funds from Health and Welfare Canada.

The expanded fourth edition will be available in September 1976. Previous editions have catalogued over 800 applications in clinical, administrative, research, and educational categories. In addition, there is descriptive information on more than 400 of the entries. The new edition will have new entries as well as updates of old ones.

For ordering information, write to: Health Computer Information Bureau, 274 Friel Street, Ottawa, Ontario, Canada, K1N 6B3.

The Bureau also publishes a quarterly newsletter, "Printout", which carries current items of interest to users of computers in the health field.

(more FORMS DESIGN, from page 1)

Systems and forms change continuously; annual revision of forms and documentation is suggested as a norm, with complete re-design and re-writing every three or four years.

The primary function of a form is to provide a standard way to collect information. However, this can be overdone. In the effort to standardize, care must be taken to avoid dehumanization. A form that ignores the human factors will not be accepted by its users and will be a failure, even if designed well.

The forms designer has to have a knowledge of colors and their effect on people and their vision before the best performance can be had. Although the psychology of color may not be perfectly understood, there are lessons that can be learned from advertising and marketing research that will aid the forms designer. Almost everything we read is printed in black ink on white paper. Studies show however that black ink on yellow paper is the most legible. Black on white is sixth on the list of legibility. Green, red, blue, and brown on white rank ahead of black, and in that order. This doesn't mean that all the forms should be black on yellow. Entries on the forms should be black and the paper should be yellow if legibility of the entries is of paramount importance. The form itself should be printed in any color other than black so that the lines and instructions are subdued and do not compete with the entries for the attention of the eye retrieving information from the form.

Color affects forms users in more subtle ways. In a marketing study several years ago, a detergent was rated "fine" when placed in a blue and yellow box, "inadequate" in a blue box, and "too strong" in a yellow box. It is reasonable to expect that a form printed on blue paper will have little chance of acceptance as compared to one printed on yellow paper in blue ink.

Besides the visual and psychological effects of color, there is a physiological effect as well. The autonomic nervous system reacts to color below the level of awareness. Studies have shown that blue lowers blood pressure but red increases it. Red is an exciting color while blue is quiet. Green and brown are neutral.

Since color affects people in so many ways, the forms designer must know what the effects are and how to use them to his advantage. Ignoring these effects invites lack of acceptance, high error rates, wasted labor, and other problems which will increase the cost of paperwork.

A brief discussion of some but not all of the basic principles of forms design has been presented. In a later issue of CYBERDENT, a tutorial on the mechanics of forms design will be printed.

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The ANNUAL BIBLIOGRAPHY OF COMPUTER ORIENTED BOOKS has been published for 1975. This is the ninth edition. More than 300 new entries have been included. There was a fifty per cent increase in the number of computer-oriented books published last year. The book is published by the University of Colorado.

All listings prior to 1970 were deleted from the new volume, except for a few classics. Over 1000 books from 224 publishers are listed. Two new categories were added to the 51 in the last edition. One new category is Data Bases with 19 titles; the other new listing is Structured Programming with seven entries.

The BIBLIOGRAPHY may be ordered from COMPUTING NEWSLETTER, Box 7345, Colorado Springs, CO 80933. The cost is $4.00 ($5.00 if an invoice is required).

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Volume 4, Number 3
Fall 1976

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AID TO DEAF AND BLIND

Deaf persons can sense sounds through a system now developed at the University of Utah. An array of minature platinum electrodes are implanted within the cochlea. The electrodes are connected to stimulus drivers which are controlled by a PDP-8 minicomputer. "Sounds" are "heard" when the electrodes are stimulated. Different tones are produced by selecting electrodes and by changing frequency.

Although the work is regarded as experimental so far, now that the approach has been proven to be rational, the next phase will be to increase the number of electrodes to produce a variety of sounds. The use of microprocessor technology should enable the minaturization of the machine, making it portable.

Dr. William H. Dobelle is Director of the Neuroprostheses Program where the work is being conducted. The address is 19 East Oakland Avenue, Salt Lake City, Utah 84115.

CAMBRIDGE SYSTEM ENABLES

BLIND TO READ PRINTING

A system has been developed to permit easy access to the ordinary inkprint page by blind persons. The automatic reading machine can enhance the educational and vocational opportunities for the blind.

Mr. Raymond Kurzweil developed the system by linking a scanner, a mini-computer, and software. The scanner consists of a computer controlled camera that converts the printed matter into digital signals. The computer program analyzes the signals, identifies the language characters and groups them into lines of text. Another part of the program converts the text into speech phonemes. After stress contours are added, the phonemes are transmitted to a speech synthesizer which produces clear human speech at a controllable rate of 150-200 words per minute. Pausing, skipping, and replaying are under control of the user.

Further information may be obtained from Mr. Kurzweil, 68 Rogers Street, Cambridge, Mass. 02142.

AMERICAN SIGN LANGUAGE

ON CAI IN CALIFORNIA

Computer terminals are being used to display images of Ameslan, the American Sign Language of the deaf, used throughout North America, for students seeking to learn the language at Golden West College in Huntington Beach, California.

Most of the more than 200 students enrolled in the program have normal hearing but are interested in learning to communicate with the deaf. The computer-assisted-instruction courses include 49 separate lessons which introduce the students to 660 signs corresponding to frequently used words and phrases.

The system is designed to work so that English words typed at the terminal cause the corresponding sign to be displayed or as a test, the sign can be displayed for the student to respond by typing the English word.

Typing at the keyboard activates a microfiche file linked to an IBM 370 Model 155-II at the Coast Community College District's computing facility.

Student reaction has been overwhelmingly positive according to Paul Culton, chairman of the impaired hearing program.

In addition, the college has over 1,000 other programs in 55 different disciplines, including history, science, and mathematics.

All of the programs were developed with A Programming Language (APL). APL is a powerful, symbolic language designed for interactive use. This application is certainly one of the more unique that has been reported.

CYBERDENT

DENTAL INFORMATION PROCESSING NEWSLETTER

EDITOR
Clifton E. Crandell, DDS

School of Dentistry
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Chapel Hill, N.C.

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TEXAS-HOUSTON IS NEW CYBERDENT SPONSOR

With this issue CYBERDENT welcomes The University of Texas Health Science Center at Houston as a sponsor, joining the other fine institutions and organizations listed on the masthead.

Dr. John C. McMahon, Chairman of the Department of Education and Research Computer Services, initiated the action that led to sponsorship. He reports, "We are developing a Data Base Management System for our 2000 Access System to handle student and patient records."

CYBERDENT appreciates the support evidenced by this sponsorship.

MICRO-COMPUTERS - BYTE

Rarely does an idea or a product come on the scene and achieve immediate success or acceptance. Certainly one of the most phenomenal exceptions in recent data processing history is the Microprocessor.

An illustration of the rapid growth of interest is given in the first issue of Byte magazine published only a year ago. Carl Helmers had published about five issues of a computer hobbyist newsletter when Wayne Green suggested publishing a slick magazine. The newsletter had a circulation of about 300 so they first thought 1000 copies of the slick would be enough. A couple of manufacturers suggested 5000 would be more like it. As the word spread, the idea snowballed. The first issue was 50,000 copies. And what had been planned as 24 pages became 96.

Another opportunity for dentistry and other health fields to move forward is here. Will we take advantage of it?

EXPENSES COMPARED FOR PROFESSIONAL SOCIETIES

An interesting study of professional societies was published in IEEE Spectrum in March 1976 (p. 64-69). The study compared expenditures, membership, and staff size. It also showed the ratio between dollars in the budget and number of members. The table below is reproduced from OR/MS TODAY (May 1976) with data on the American Dental Association added:

PROFESSIONAL SOCIETIES 'VITAL STATISTICS'

	Budget (millions)	Membership (thousands)	Staff Size	Exp. per member ($/member)
American Medical Association	52.0	172	832	302
American Institute of Architects	6.0	26	123	231
American Chemical Society	17.4	110	400	158
American Society of Mechanical Engineers	8.6	73	193	118
Inst. of Electrical & Electronics Engrs.	20.0	180	268	111
American Bar Association	22.0	205	450	107
American Inst. of Chemical Engrs.	3.2	37	70	86
American Society of Civil Engrs.	5.8	70	115	83
American Inst. of Mining, Met. & Petr. Engrs.	3.5	54	80	65
TIMS (not in original sample)	.4	6.6	5	61
National Society of Professional Engrs.	2.0	71	70	28
Am. Dent. Ass'n	12.8	107	?	119

HEALTH INDUSTRY DUE GREATEST COMPUTER GROWTH

International Data Corporation has released a report, "Target Industries for Computer Services and Minicomputers", which indicates that health care related industries hold the highest potential for computer acquisition. Hospitals lead the way with a market potential of $2.7 billion which is 4.6 times the size of the next largest market.

Some hospitals now spend as much as $7 per day per patient for data processing services. The average is thought to be about $2.50 per patient day.

Further information may be obtained from Marvin Goldberg, Director of Pulic Relations, International Data Corporation, 214 Third Avenue, Waltham, MA 02154.

SOCIAL SECURITY

ERROR RATE OVER 23%

Almost one-fourth of the computer-generated checks sent to recipients of Supplemental Security Income have errors, according to an article in Computerworld (May 10, 1976).

The Quality Assurance Program of the Social Security Administration sampled payments made to the 4.3 million people covered under this program and found that 23.7% of the checks were incorrect. SSA Commissioner James B. Cardwell explained to the House Ways and Means Oversight Subcommittee that the high rate was related to "client behavior" and the interface with other SSA programs.

A breakdown of the 23.7% error rate shows 9.8% were overpayments, 6.1% were underpayments, and 7.8% were to ineligible recipients.

The agency's request for larger, more sophisticated, and more expensive computer operations has come under sharp criticism from several computer scientists. The House Government Operations Subcommittee has ordered the General Accounting Office to audit the SSA's computer operations.

AMA OFFERS COMPUTER

BIBLIOGRAPHIC SERVICE

Computerized bibliographic searches are now available to members of the American Medical Association through their Division of Library and Archival Services and the National Library of Medicine.

The MEDLINE system now offers searches from the following files: MEDLINE (journals), CATLINE (books), SERLINE (serials), SDI-LINE (current month Journals), CANCERLINE (cancer literature), and TOXLINE (toxicology literature).

Computer searches are free to members of the AMA and $15 to non-members. Photocopy reprints of the journal articles are available at 10¢ per page plus a $3 minimum handling charge.

FORUM ON MEDICAL RECORDS

TO BE HELD IN ARLINGTON

The Center for Hospital Management Engineering will conduct a two-day forum of quantitative case studies of medical records systems in Arlington, Virginia March 14-15, 1977.

The call for papers requests abstracts of no more than two double-spaced pages by September 20. The papers must be related to increased productivity or increased quality of service through the use of management engineering techniques to accomplish staffing changes and task reallocation, or to improve manual or computerized medical records systems. Papers must report projects that are complete, significant, and results-oriented.

Further information may be obtained by writing to the Forum Coordinator, Forum on Medical Records Department, Center for Hospital Management Engineering, Division of Management Effectiveness, American Hospital Association, 840 North Lake Shore Drive, Chicago, Illinois 60611.

DENTIST PATENTS NEW

TOMOGRAPHIC MACHINE

Many articles are appearing in the literature today on computer-controlled tomography systems. A dentist at Georgetown University Medical School, Dr. Robert S. Ledley, has been issued a patent for an X-ray machine that scans any organ or the whole body, and immediately displays a cross-section of the area. Dr. Ledley has been involved in research in the use of computers in medicine and dentistry for many years. Formerly with the National Biomedical Research Foundation, he is the author of "Use of Computers in Biology and Medicine" (McGraw-Hill, 1965, 965 p.) and many other articles.

Tomography involves rotating the X-ray tube and the X-ray detectors around the body with the area of interest in the center of the plane of rotation. The scanning signals are fed into a computer which generates a picture on a color television receiver.

Localization of lesions is more accurate, less radiation is used, and resolution down to one millimeter is possible.

Although the machine costs about 20 times that of more conventional machines, there are about 50 of them already in use.

SCAN-DATA ADVANCES OCR

Scan-Data has announced two significant additions to its product line of optical character reading equipment.

A new system offered is capable of recognizing intermixed alphanumeric handprinted input directly from source documents. Projected applications would be mixed letters, numbers, and symbols such as part numbers, street addresses, and motor vehicle numbers. Area-Scan is a new feature which is an extension of the continuous-feed option. This makes the system more compatible with forms design for IBM 1287 and 1288 OCR systems, facilitating conversion to Scan-Data equipment.

A typical system with alphanumeric handprint capability costs between $8,000 and $10,000 per month. The continuous-feed option which includes Area-Scan, starts at about $5,000 per month, according to the Norristown, Pennsylvania firm.

BASIC FORMS DESIGN:

MECHANICS OF LAYOUT

In CYBERDENT Volume 4, Number 2, Summer 1976, an introductory tutorial was presented on Basic Forms Design. This series continues in this issue with a discussion and examples of the Mechanics of Forms Design.

EQUIPMENT

The range of equipment varies widely, depending on how sophisticated one wishes to become in designing forms. Many printshops have experienced personnel who can respond to the designer's needs in an acceptable manner. In this instance, all the designer needs is pencil and paper to sketch what is desired, look at the proof when it is ready, and implement the use of the form when it is printed. The advantage of this approach would be a reduced outlay for personnel in-house. Against this would be greater overall expense and loss of control over forms production. Also the burden of documentation increases. Further, it requires a skilled forms designer to pencil-design a form and obtain optimal spacing, both vertical and horizontal.

By the use of typewriters having interchangeable type, such as the IBM Selectric, camera-ready copy can be given to the printer, saving time and money if the form to be printed doesn't require a high level of sophistication. The vast majority of forms used in dental practice or dental education fall in this group. Since most dental educational institutions and a significant number of dental practices possess such typewriters, it seems prudent to use them for this prupose.

An essential item of equipment is a forms ruler, one made especially for forms designing. Moore Business Forms, Inc., Standard Register, and others offer these rulers for about $3.00. These steel rulers are 16 inches long and have several scales, including six spaces to the inch and ten spaces to the inch.

SYSTEMS ANALYSIS

The form cannot be designed until a thorough systems analysis has been done. This would include a flow chart for the information that is to be recorded on or retrieved from the form, whether the form is to be filled in by hand or typewriter or both, how it is be stored, how many copies, and the size needed.

From the systems analysis, a list of the information that is to go on the form is made and beside each item an estimate is made of the number of characters (including blanks) required to enter the information needed. Such a list might look like this:

Item	Char.
Patient's name	20
Street address (line 1)	20
Street address (line 2)	20
City	20
State (two-letter abbrev.)	2
Zipcode	5
Age	2
Year of birth	4

Once the list is written, the forms designer can use the knowledge gained in the systems analysis to plan the placement of the items on the form. For example, from the list shown, the first six items make a very logical group. Since people have been indoctrinated almost from birth that name, street, and city are stacked one over the other, it would be wise to place them that way on the form. State and Zipcode pose a problem because of their length. Age and Year of birth could be the beginning of another group such as Sex, Race, etc. A good case can be stated for eliminating Age or Year of birth since one can be calculated from the other. Year of birth would be an advantage since it would not have to be updated.

THE 3 x 5 RULE

In the 3 x 5 Rule, the three stands for the number of lines per inch in a vertical direction when a typewriter is double-shifted or double-spaced; the five stands for the number of characters per inch in a horizontal direction when a typewriter types every other space. Pica spacing is 10 characters per inch and is the standard around which forms are designed. Elite spacing is 12 characters to the inch and will fit into anything designed for Pica. In general, handwriting will require twice as much space, both vertically and horizontally, as Pica spacing, hence the three means that three lines of handwritten copy will fit into each vertical inch and the five means that five characters of handwritten copy will fit into each horizontal inch. This will provide an abundance of space for entries that are typed. If all the entries on a form are to be typewritten, the 3 x 5 rule can be doubled and 6 x 10 can be used but such forms appear very crowded and registrations are very difficult to maintain throughout the form.

ALLOCATION OF SPACE

Using the list of items, allocate the horizontal spaces according to the 3 x 5 rule by adding another column to the list. This column uses inches as a unit. The list now looks like this:

Item	Char.	Inches
Patient's name	20	4
Street address (line 1)	20	4
Street address (line 2)	20	4
City	20	4
State (two-letter abbrev.)	2	0.4
Zipcode	5	1.0
Age	2	0.4
Year of birth	4	0.8

Stacking of the name and address is important because of conditioning as mentioned above. It is also very important if the form is to be filled in with a typewriter because tab stops can be set for a series of stacked items if they are aligned vertically. Otherwise, the typist will waste much time doing aligning the stacked items by tapping the space bar and making the same judgements about space each time the form is filled in.

It is desirable to place the City, State, and Zipcode on a single line. This can be achieved in several ways: Patient's name and Street address can be made shorter, allowing only 13 characters, which is not enough; lengthen Patient's name and Streetaddress to 27 characters, which is generous; or lengthen State to 15 characters and place it on another line with Zipcode; or shorten City to 13 characters.

BOXING THE ENTRIES

Most forms in use today have the instruction or entry indication typed on the line and to the left of the space where the entry is to be made, like below:

Patient's name ______________________________

Street address ______________________________

In this example, the first 13 spaces of each line is used for the instruction. Assuming a similar use of the rest of the form, it appears that from 30 to 75 per cent of the space will be taken up by the instructions. This approach forces one page forms to become two and three page forms with a proportionate increase in printing, handling, and storage costs, not to mention the bad psychological effect on the user, who then becomes careless, increasing the error rate and degrading the data.

Placing the entries in boxes makes all of the form available for entries, de-emphasizes the instructions, thereby making the retrieval of data easier, and also reducing the error rate and user resistance. The same items in boxes would appear like this:

Patient's name
Street address

By placing the entries in boxes, an increase in the amount of space available for making entries is achieved (24 per cent), and in the example shown the total mount of space used is reduced 16 per cent, making this form 40 per cent more efficient.

Further, the line forming the box is heavier above and to the right, thereby making the logical groups of items more distinct.

EXPLICIT INSTRUCTIONS

The boxed example above can be improved further by the addition of further, more explicit instructions with no sacrifice in space. The preferred order of listing Patient's name should be printed on the form, thus:

Patient's name (last, first, middle)

This avoids confusion in retrieving the data and in filing the form, as well as assuring correct entries. Since a person's name is a very personal characteristic, errors can be costly,unpaid bills being a good example.

This may seem trivial but experience indicates that there are a surprisingly large number of people who have names that could be first, middle, or last names. John Robert Thomas is an example. In addition, if the decision of placement is made at the time the form is designed, that decision doesn't have to be made each time the form is filled in or information retrieved from it.

In the case of Street address, this instruction could be expanded to include other possibilities, thus:

Street, Box, RFD, or Building

It is easy to imagine a patient stumbling over filling in Street address if they had a Box, RFD, or Building address, asking a dental assistant or receptionist for clarification, using time of both that could be better spent in another pursuit.

Further considerations in the Mechanics of Forms Design will appear in future issues of CYBERDENT.

HOSPITAL ASSOCIATION PROVIDES ABSTRACTS

The Keydex System is being used by the American Hospital Association's Center for Hospital Management Engineering to provide an abstracting service. In this system, each keyword is represented by a gridded card, and if a report is referenced by that keyword, a hole is drilled in the card at the grid-point determined by the report number. If the keywords selected by a user are a subset of the keywords for a report, that report number can be determined by the continuous hole is the stack of cards. Once the report is known, the abstracts can be pulled, copied, and sent to the user.

The list of keywords has more than 300 entries, including Communication, Communication Systems, Computer Hardware and Software, Data Collection, Data Processing, Dental Care, and Dentists. Collections of reports selected on these keywords are currently available and listings of reports by title and by author are expected to be available soon, probably by September.

The price for duplicating reports is 15¢ per page. The service is available through the Center's office at the American Hospital Association, 840 North Lake Shore Drive, Chicago, Illinois 60611.

FEBRUARY 6-12, 1977

National Children's Dental Health Week

Sponsored by the **American Dental Association**

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TIME SHARING GROUP

CELEBRATES FIRST BIRTHDAY

Congratulations are due the Association of Time Sharing Users (ATSU) on its first birthday. Although only in existence for one year, the Association already has more than 1000 members.

ATSU is an independent non-profit association which provides a forum for the discussion of time-sharing-related topics and disseminating information to members about interactive products and services.

There are eight Special Interest Groups in the Association: Financial Modeling, Terminal Comparisons, Data Base Applications, Data Security, In-House vs. Outside Time-Sharing, Econometric Application, Standards and Program Portability, and Educational Applications.

Local chapters have been organized in Atlanta, Boston, Chicago, Cleveland, Denver, Detroit, Houston, Los Angeles, Northern New Jersey, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis, and Toronto.

The organization boasts of 15 Corporate Associate members that supply time-sharing services or related products.

The membership fee of $45 per year includes a subscription to Interactive Computing, the monthly newsletter, and directories of programs and personnel. The Association maintains offices at 210 Fifth Avenue, New York, NY 10010.

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(see MORE REFERENCES, next page)

CYBER-MEETINGS

October 11-13, 1976: THIRD ANNUAL COMPUTER-ASSISTED TEST CONSTRUCTION CONFERENCE in Chicago, IL. Contact: CATC Conference, Educational Testing Service, 960 Grove Street, Evanston, IL 60201

October 19-21, 1976: MINI/MICRO COMPUTER CONFERENCE AND EXPOSITION at San Francisco. Contact: Robert D. Ranking, Managing Director, Mini/Micro Computer Conference and Exposition, 5544 East LaPalma Avenue, Anaheim, CA.

October 24-27, 1976: INFO/EXPO, DATA PROCESSING MANAGEMENT ASSOCIATION in Las Vevas, NV. Contact: DPMA, 505 Busse Highway, Park Ridge, IL 60068.

November 3-6, 1976: OPERATIONS RESEARCH SOCIETY OF AMERICAN/THE INSTITUTE OF MANAGEMENT SCIENCES in Miami. Contact: H. Donald Ratliff, Dept. of Ind. and Systems Engineering, Univ. of Florida, Gainesville, FL 32601.

November 11, 1976: COMPUTER-AIDED DIAGNOSIS OF MEDICAL IMAGES in San Diego, CA. Contact: Prof. Jack Sklansky School of Engineering, University of California, Irvine, CA 92717.

November 8-12, 1976: THIRD INTERNATIONAL JOINT CONFERENCE ON PATTERN RECOGNITION in San Diego, CA. Contact: Pattern Recognition, PO Box 638, Silver Spring, MD 20901.

November 10-12, 1976: SOCIETY FOR ADVANCED MEDICAL SYSTEMS in Boston, MA. Contact: Patricia Horner, Executive Director, SAMS, Suite 1350, 5454 Wisconsin Avenue, Chevy Chase, MD 20015.

November 11-13, 1976: SOCIETY FOR COMPUTER MEDICINE Sixth Annual Conference in Boston, MA. Contact: Neal Koss, Yale University School of Medicine, 333 Cedar Street, New Haven, CN 06510.

Louis A. Saporito, D.D.S. National Chairman AFDH Dentists Campaign at his Alma Mater Columbia University School of Dental and Oral Surgery

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211 East Chicago Avenue Suite 1630 Chicago Illinois 606[illegible]

November 8-11, 1976: INFO 76 in Chicago, IL. Contact: Clapp and Poliak, Inc., 245 Park Avenue, New York, NY 10017.

November 24-26, 1976: INTERNATIONAL CONGRESS ON COMPUTING IN MEDICINE in Berlin. Contact: Online, Brunel University, Uxbridge, Middlesex, England.

December 13-15, 1976: SEVENTH ANNUAL CONGRESS ON ADVANCES IN AUTOMATED ANALYSIS AND INFORMATION SYSTEMS in New York. Contact: Technicon Corp., Tarrytown, NY 10591.

August 8-13, 1977: MEDINFO 77 - SECOND INTERNATIONAL CONFERENCE ON MEDICAL INFORMATION SYSTEMS in Toronto. Contact: J. F. Brandejs, chairman MEDINFO 77 Organizing Committee, Box 8650, Ottawa, Ontario K1G 0G8, or Dr. D. Lindberg, co-chairman MEDINFO 77 Organizing Committee, Information Science Group, Lewis Hall, School of Medicine, University of Missouri, Columbia, MO 65201.

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Hassani, N. Principles of computerized tomography. J. Natl. Med. Assoc. 68: 110-112, Mar. 1976.

Keller, R. A. and Baily, N. A. A computer program for the localization of small areas in roentgenological images. Invest. Radiol. 11: 125-133, Mar.-Apr. 1976.

Kohler, C. O., Wagner, G. and Wolber, U. Interactive data processing in medicine-man-machine dialogue. Methods Inf. Med. 15: 102-120, Apr. 1976.

Kowitt, J. P. and Rudow, B. J. Computer printout on microfiche speeds record keeping, retrieval. Hospitals 50: 81-83, June 1, 1976.

Lipscomb, Joseph, and Scheffler, Richard M. Impact of Expanded-Duty Assistants on Cost and Productivity in Dental Care Delivery. Health Services Research 10(1): 14-35, Spring 1975.

CYBER-COURSES

A brief listing of opportunities in continuing education of interest to those working in information processing in health fields.

(Those wishing to list their courses here should send announcements to the Editor).

DESIGN OF TELEPROCESSING NETWORKS AND DATA BASE SYSTEMS FOR THE FUTURE. October 4-8, 1976 in Cherry Hill, NJ by James Martin and ISCOL Limited (International Systems Corporation of Lancaster). $695. Contact: Mrs. Margot Collins, Cherry Hill Hyatt House, 2349 West Marlton Pike, Cherry Hill, NJ 08034.

PRIVACY AND SECURITY FOR PROFESSIONALS. October 6-7, 1976 in Chicago, IL by Mark Ramm, Javier Kuong, and Lawrence Holland, Institute for Advanced Technology. $320 ($345 if late or invoiced). Contact: Registrar, IAT, Control Data Corporation, 6003 Executive Blvd., Rockville, MD 20852.

COMPUTER OPERATIONS MANAGEMENT. October 13-15, 1976 in Bethesda, MD by Leonard A. Kreuter and Thomas H. Farello, Institute for Advanced Technology. $460 ($485 if late or invoiced). Contact: Registrar, IAT, Control Data Corporation, 6003 Executive Blvd., Rockville, MD 20852.

DATA BASE MANAGEMENT SYSTEMS. October 13-15, 1976 in Scottsdale, AZ by Harold Uhrbach, James R. Deline, Bernard K. Plagman, John Quinn, and Institute for Advanced Technology. $460 ($485 if late or invoiced). Contact: Registrar, IAT, Control Data Corporation, 6003 Executive Blvd., Rockville, MD 20852.

MICROPROCESSORS. October 27-29, 1976 in Washington, DC by Keith L. Doty, George Washington University. $385. Contact: Continuing Engineering Education, George Washington University, Washington, DC 20052.

STRUCTURED PROGRAMMING AND SOFTWARE ENGINEERING. November 1-5, 1976 in Washington, DC by Victor R. Basili, Harlan D. Mills, and George Washington University. $425. Contact: Continuing Engineering Education, George Washington University, Washington DC 20052.

THE PAPER DOCTOR. December 4, 1976 in Chapel Hill, NC by C. E. Crandell and the University of North Carolina. $50 for doctors, $25 for auxiliaries. Contact: Continuing Education, School of Dentistry, University of North Carolina, Chapel Hill, NC 27514.

BASIC FORMS DESIGN. December 5, 1976 in Chapel Hill, NC by C. E. Crandell, Karen Scarlett, and the University of North Carolina. $50. Contact: Continuing Education, School of Dentistry, University of North Carolina, Chapel Hill, NC 27514.

COMPUTER MONITORING OF DENTAL ACTIVITIES. June 1-2, 1977 in Chapel Hill, NC by C. E. Crandell et al, and the University of North Carolina. $120. Contact: Continuing Education, School of Dentistry, University of North Carolina, Chapel Hill, NC 27514.

CYBER-BOOKS

Books that are available to health professionals working in operation research or data processing.

(Contributions are invited. Send to the Editor).

OPERATIONS RESEARCH IN HEALTH CARE, A CRITICAL ANALYSIS, edited by John P. Young, Larry J. Shuman, and R. Dixon Speas, Jr. This collection of papers provides an evaluation of the application of operations research methods to health care services. The Johns Hopkins University Press, Baltimore, MD 21213. $16.

SYSTEMS ASPECTS OF HEALTH PLANNING, edited by Norman T. J. Bailey and Mark Thompson. Proceedings of the IIASA Conference in Baden, Austria, August 20-24, 1974. Horth-Holland Publishing Co., 52 Vanderbilt Avenue, New York, NY 10017. $23.95.

COMPREHENSIVE CARE IN CLINICAL DENTAL EDUCATION, edited by C. E. Crandell. Proceedings of the Second Conference in Whispering Pines, NC July 27-30, 1975. Dental Data Center, School of Dentistry, University of North Carolina, Chapel Hill, NC 27514. $2.

CYBERDENT
DENTAL INFORMATION PROCESSING NEWSLETTER

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CYBERDENT

ENTAL INFORMATION PROCESSING NEWSLETTER

Volume 4, Number 4
Winter 1976

Dental Clinic System at MUSC in Charleston

An on-line student clinical information system has been developed for the College of Dental Medicine at the Medical University of South Carolina. In addition to provision for complete monitoring of student progress in the clinics, the system also provides clinic utilization studies and reporting of student-patient financial status. The system is flexible and completely modular in design, so that any clinic in the dental school may utilize the system according to its own need, independently of any other clinical area. Each clinic may develop and use the grading scheme, patterns of data entry, and reporting formats most appropriate for that area of dentistry. Data entry and report generation are under the control of the individual clinics, but unified reports and special studies using all clinic data bases are prepared for school administrators as well.

There are four basic operational elements in the system: 1) patient registration, 2) appointments, 3) grade and fee recording, and 4) report generation. In order to minimize storage utilization, only the data necessary for monitoring student status is kept. At patient registration, for example, the patient's name, chart number, date of visit, and a 24-point dental problem summary (one-character code per point) are recorded. Date of last visit and the ID number of the student assigned to the case are variables added or changed later. These data are always entered on-line, in real-time, at the registration desk or in the record room.

By incorporating an appointments phase into the system, basic data for each student-patient encounter can be entered prior to the visit. The identifying information about the student and patient, the clinic, operatory, date, time, and procedure to be done are entered via CRT's at the appointments desk up to two weeks before the appointment. Clinic schedules for the next day are printed and distributed as well. The appointments phase can function as an independent system, and in fact it was put into use before any individual clinic applications were implemented.

On the day of a visit, at the convenience of busy clinic personnel, the grades given that day, or fees charged or collected, are entered on-line and in a format tailored for each clinic. There is no need to re-enter the identifying information which was recorded when the appointment was made. The system will accomodate procedures for which several grades are given, and procedures or cases which span quarters.

Report generation may follow a regular schedule or it may be by demand, and the reports can be requested from the user terminal or from the data-processing staff. Virtually every level of reporting is available for students, faculty, staff, and administrators. Typical reports are individual and summarized grades, by student or by class, by quarter or by year; student progress in each clinic or summarized for all clinics; case status or status of the financial account for each patient or for all of a student's patients; clinic utilization each quarter by clinic, by student, or by procedure.

This general system design is adaptable to virtually any dental school or other clinical unit with several subdivisions, with or without a centralized appointment scheme. It is adaptable to any hardware and programming combination which allows on-line data entry. This implementation, which is nearly complete, is on a PDP11/40 with 64K words of core memory, 20M words of disk storage, and 16 CRT's for clinical use. All programming has been done in 8K word modules, using the BASIC-PLUS language. The most challenging aspects of implementation have been found to be at the man-machine interface, and most design features such as a maximum two second response time have been oriented toward the needs and constraints of clinic personnel.

There are some additional

(see MUSC, page 5)

CYBERDENT

DENTAL INFORMATION PROCESSING NEWSLETTER

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DENTAL DATA CENTER

EDP MANAGEMENT

The measurement of productivity of creative people is considered to be impossible by many, and extremely difficult by almost everybody else. Various schemes have been devised by data processing managers. Books by Wadsworth (EDP Project Management Controls, Prentice-Hall, Inc., Englewood Cliffs, N. J., 1972), Mixon (Handbook of Data Processing Administration, Operations, and Procedures, American Management Association, New York, 1976), and others are available. In addition, lectures and tutorials are on the programs of computer conventions on "Project Management", "Production Control", or "Measuring Programmer Throughput".

Typically, a discussion of programmer effectiveness begins on a negative note as one manager or another cites examples from his experience about time and cost overruns, missed deadlines, absenteeism. Still, there are some who claim not to have the problem, of which there are two groups: (1) one who doesn't know whether there is a problem or not since there are no deadlines, no schedules, no concern for cost-effectiveness, no (unlimited) budget. (This group has all but disappeared). (2) one who has found the "best" way to handle the problem. (This group is getting larger).

Documentation ("Oh, how I loathe documentation!") is frequently a significant segment of the systems that seem to work well. A project is identified by a name, a number, a client (user), and an initiater. The first step is to define the project or determine as nearly as possible what the user or client wants or needs. After definition, the time of various people involved can be allocated. The project may require a systems programmer, a systems designer, a junior programmer, a forms designer, etc. The estimates of time for each person may be in units of hours, days, weeks, depending on the size and complexity of the project, the size of the staff, the degree of productivity measurement required, or other factors.

Meetings or reports will be scheduled at daily, weekly, or monthly intervals to ascertain progress, discover problems, offer solutions, change approach, or other management functions. These meetings or reports may be used as weapons or as tools, depending on the set of circumstances arising.

Studies have shown that projects usually take about 2.7 times as long and cost 2.7 times as much as the first estimate. The smart EDP manager will therefore multiply his first estimate by 3, but he will never say "I told you so" when his superior refuses to accept the 'exploded' estimate which turns out to be painfully accurate.

COMPUTER PROGRAM VIA SATELLITE

A new computer simulation program has been developed at the University of Florida which may be used to determine the cost effectiveness and efficiency of dental practice. Practitioners can easily determine the effect of changing staffing, allocation of space, and procedure delegation in the dental office. The system will provide answers to questions such as, "What would be the effect of hiring an additional assistant?" or "What would be the result if another operatory was added?"

The program is being offered to other institutions via communications satellite. This marks perhaps the first experience where dental education is dispersed by extraterrestial means. The satellite, which weighs 674 kilograms, was launched jointly by the United States and Canada last January. It will be used for communications experiments.

The three-part closed circuit program has been allocated six hours of satellite time. It will be transmitted to the satellite via an antenna at the Lister Hill National Bio-Medical Communications Center in Bethesda, Maryland.

Scheduled to be initiated this spring, five dental schools have been identified as viewing sites: Howard University and Georgetown University in Washington, University of Kentucky in Lexington, University of Washington in Seattle, and the University of Colorado in Denver.

Dr. Kerry Kilpatrick, director of the program, and Thomas Kiski, management systems director at the University of Florida, will be available for two-way communications follow-up when the broadcasts are made. Kilpatrick says dentists may use the system to make evaluations of the effectiveness of several dental office arrangements instead of experimenting through several years of trial and error.

The computer simulation program has been under development since 1971 at the University of Florida. Funding has been from the Department of Health, Education and Welfare. It is anticipated that the program will be of interest to many persons and that the computer program may be installed at several locations. A similar program is operating at Case Western Reserve University in Cleveland and is being installed at the University of North Carolina in Chapel Hill. There is also a computer program in use in Minnesota that aids in the selection of a practice site.

ELECTRONIC DIGITIZER AT UNC

The University of North Carolina at Chapel Hill is one of only five universities in the country that now own an electronic digitizing system capable of recording graphic data faster than the human eye or hand can move.

The universities of Illinois, Wisconsin, California at Los Angeles and the Massachusetts Insitutue of Technology are the others.

A digitizer translates maps and graphics into numbers for processing by computers. The computer enables the user to manipulate and massage the data and adapt the original graphic to suit his needs. UNC's new system, capable of digitizing at the rate of 300 inches per second (for instance, it will take only four hours to digitize a map of North Carolina complete with counties and all details), was installed last month in UNC's Geography Department, but will be used by at least 18 other University departments.

Geography Prof. Richard J. Kopec said he visualizes many uses for the system.

"Anyone needing graphics, maps or graphs can use it," he said. "Geologists can make contour maps or show measurements below the surface as they relate to petroleum deposits or earthquake activity. Marine scientists can do isobath studies -- showing the depths below the water's surface. Geographers can illustrate measurements within points on a map. The system's utility is limited only by the imagination of those who use it."

Although UNC's system was made specifically for its use, there are some 250 similar versions now in use to digitize information for a variety of purposes. The cloud formations and hurricane activity on our television weather reports are made possible by digitizing information and projecting it on the screen.

Digital computers have helped make decisions on awarding rubbish removal contracts in New York City. In the past, each contractor had to figure his own route and mileage. Using the computer, the city figured the exact mileage and best and shortest route, and the bids went out on that basis, saving the city time and money.

The digitizer makes work easier for copyright infringement experts in Nashville. With all the music competing for copyrights in that country-music center, it was a major chore to determine infringements. Now the sheet music is read through the computer and quickly compared for similarity.

Walt Disney productions uses a similar digitizer to draw Mickey Mouse cartoons. The layout for the Disney World amusement park was digitized on a computer from aerial photographs.

The UNC system has four basic components: a drafting-type table, a curser, a magnetic tape console and a 28-character floating keyboard.

The magnetic tape console, to which will be added a card-punch system as funds permit, records and stores the data it receives from the operator. The 28-character keyboard is used to give the system instructions on specific programs. The possibity of using the digitizer to prepare drawings of teeth will be explored by the School of Dentistry.

ON-LINE MEDICAL INFO SYSTEM

An on-line medical information system has recently been implemented at Schoitz Memorial Hospital in Waterloo, Iowa to handle an enormous increase in outpatient visits.

The system uses 100 CRT terminals to connect various stations to a Univac 90/30 central processor. The terminals are Univac Uniscopes.

Outpatient medical records can be displayed on the CRT's by referring to the patient's name, social security number, or hospital number. Services rendered and charges are also entered at the terminals. Hard copy printout may be obtained from printers attached to the terminals.

DENTAL INSURANCE CLAIMS AUTOMATED

Aetna Life and Casualty Company has introduced on-the-spot medical and dental insurance claim payments. The computerized claims service is said to be the first of its kind. The system has been installed at the firm's claims office in Hartford, CT. Over the next year and a half, Aetna plans to install the system in 39 other locations across the country.

The Aetna Computerized Claims System (Aecclaims) has been in operation since July 1. When completed it will represent an investment of more than four million dollars.

Each site will have Bunker Ramo Model 90 equipment. Aetna's central computer is an IBM 370/168. There will be 16 to 60 CRT terminals at each site, a total of more than 1,000. The CRT's will have 12-inch, 1920-character display screens.

The system will save time in the processing of claims and is also expected to reduce the rate of increase in the cost of processing claims.

COMPUTER AIDS IN DIAGNOSIS

SSD (for Sign, Symptom, and Diagnosis) is the name of a system designed to make computers more useful to physicians through a computer-assisted diagnosis.

The program was written by a physician and proceeds from general questions to more specific queries, thus helping to prevent overlooking possibilities.

The physician uses a video display terminal in the examining room where he selects items on lists of regions, disorders, etc. as they are displayed on the screen. The computer then displays additional lists until the physician makes a diagnosis.

SSD is flexible, allowing each physician to develop his own strategy. The system is a part of the Medecomp systems which are priced at $16,000 up.

TWO SYSTEMS FOR DRUG INTERACTIONS

REALITY COMPUTER

An on-line system for providing pharmacists and other health professionals with information concerning drug interaction and contraindication is now available from Health Care Computer Systems of Jenkintown, PA.

The system maintains each patient's drug program and when data on new medication is entered, the program searches the file for the effects of interaction of the two or more drugs and displays the potential problems.

The system can also produce billing, bottle labels, and patient profiles.

The system was built around the Reality computer from Microdata. The applications programs are written in Basic but users can use Microdata's "English" language to interact with the system The system is available for purchase or time-sharing.

MEDIPHOR SYSTEM

Mediphor is a system designed to prevent dangerous drug interactions in hospitals. It is a software system which runs on System 830, a pharmacy management system from B-D Spear Medical Systems.

In addition to providing warnings and other information on severity, immediacy, and clinical significance of drug interactions, the system also handles record keeping and other functions.

An audible as well as a visual alert occurs when warnings are indicated.

The system would cost about 25¢ per patient day in a 400 bed hospital. The purchase price is about $100,000.

Systems Designers beware -

"If the only thing you have is a hammer, you tend to treat everything as though it were a nail."

- Abraham Maslow

Computer Publications Increase

JOURNAL OF MEDICAL SYSTEMS

The Journal of Medical Systems will begin publication in the first quarter of 1977. Editing the new journal will be Ralph R. Grams, a member of the department of pathology at the University of Florida.

The new journal will be devoted to the use of computers in medicine. Grams predicts that the microprocessor will have significant impact on medical use of computers.

Several years ago, the government allocated large sums of money for research in computers in the health care field. As a result, computers have been linked with many medical instruments. Grams added that few of these systems proved to be cost-effective. These approaches are now being reviewed to determine direction for future development.

The main emphasis for the future will be the medical data base, how to capture and maintain medical data.

The Editorial Board of the new journal will come from the Computer Society of Medicine, the American Medical Association, and other groups.

CANADIAN JOURNAL OF INFO SCIENCE

The Canadian Journal of Information Science began publication in June 1976. It is the journal of the Canadian Association for Information Science. Further information may be obtained from Frank T. Dolan, CAIS, School of Library and Information Science, The University of Western Ontario, London, Ontario N6A 5B9.

JOURNAL OF HEALTH SYSTEMS

Plenum Press will begin publication in 1977 of a new journal, Journal of Health Systems. The Health Applications Section of the Operations Research Society of America has decided to affiliate with the new quarterly.

Harvey Wolfe and Kerry Kilpatrick will represent HAS on the editorial board.

Marco runs on Mumps in Boston

A disk-based minicomputer system is being used in Boston to permit calling up via CRT's the medical records of nearly 9,000 young patients. Personnel at Boston City Hospital and at Harvard Street Neighborhood Health Center have access to summaries of each child's history and record of treatment.

The system is called Marco for Medical Records Communication system and is based on a PDP 11/45 which runs on a Mumps operating system. There is 28K of core memory and 160 million bytes of disk storage on two drives. At each location, there are two CRT's and one printer.

Dr. Joel Alpert, head of the department of Pediatrics at Boston University School of Medicine, developed the system.

Before the system was installed, records had to be retreived from another building. This frequently resulted in treating without the record because the treatment could be rendered by the time the record could be retreived. Also, there was a shortage of personnel to retrieve records.

Previously, only about 10% of the hospital encounters were legibly recorded in the Neighborhood Health Center records. Now, using a General Pediatric Encounter Data Sheet, the health provider has a series of checklists which has standardized entries to an appreciable degree. Data from the Encounter Sheet is keyed into the system by an operator and can be accessed at a later date. The accuracy and length of records is said to be increasing.

CANCER STUDY AT UNIV. OF HAWAII

Researchers at the University of Hawaii are searching for a relathionship between breast cancer and height, weight, race, diet, and occupation.

The Cancer Center at the University, with funds from the National Cancer Institute, maintains a large computerized data base on over 200,000 families in Hawaii. The data is maintained on an IBM 370/158.

Hawaii is deemed a desirable site for this research because of the unique racial mix. Of 910 cases of intraductal breast carcinoma reported to the Hawaii Tumor Registry from 1968-1972, the rate varied from 21.5 per 100,000 females of Filipinos to 67.3 per 100,000 females of Caucasian origin.

(more MUSC, from page 1)

features of the system which should be noted. The system can be used whether the school uses comprehensive case care, a unit requirements system, or a combination of both in assigning patients to students and tracking their progress. The system is immune to such inevitable periodic changes in screening procedures, number of clinics, size of clinics, and grading schemes. Each clinic's files are almost identical in design to facilitate programming and documentation. As many files as possible are common to all clinics to save space, but each clinic's records are protected from other users.

All phases of the system have been programmed, tested, and implemented in several clinical areas, except summarized grade reporting across clinics. This and other unifying procedures await the phasing-in of the remainder of the clinical areas.

For additional information, contact Dr. Karen A. Duncan, Office of Computer Resources, Medical University of South Carolina, 80 Barre Street, 453 Basic Science Building, Charleston, South Carolina, 29401.

Clinical Computing Features Dentistry

The Journal of Clinical Computing is devoting two issues to the use of computers in dentistry.

Dr. E. R. Gabrieli, editor of the journal and a pathologist, said that ready access to the patient's complete medical history is useful to the dentist and physician.

The two special issues were edited by Dr. Karen Duncan, director of of the office of computer resources at the College of Dental Medicine of the Medical University of South Carolina in Charleston.

After a guest editorial by Dr. Duncan and an introduction by American Dental Association President Robert B. Shira, there are articles describing several computer based systed that are in operation at schools, clinics, and private practices.

Marvin Marcus and Donald Bleich wrote on "An Interactive Graphic Capitation Model", from UCLA. Dr. Duncan's article described "Real Time Clinic Management", a system in use at the Medical University of South Carolina.

The Student Scheduling System of the University of North Carolina was described by C. E. Crandell.

"Computers in the Private Dental Practice" was the title of an article by John S. Bauernfeind.

FICHEING AUTOMATED BY IMAGE SYSTEMS

Image Systems of Culver City, CA is now marketing a computer-driven microfiche system designed for computer-assisted instruction.

The unit can store up to 780 images which are retrieved and displayed when called by use of a keyboard.

The single unit price is under $6000 and the computer interface is $2395.

SMALL PRACTICE UNIT FROM NCR

NCR has announced a computer system designed to handle the data processing needs of the small private practice of medicine or dentistry. The billing program provides for a statement with five credit descriptions and up to 70 services. Self-addressed return envelopes are also done.

The accounts receivable program posts receipts and provides an aged analysis. Cost? $12,500.

CASE WESTERN HEART MONITOR

Case Western Reserve University Hospital has under development a minicomputer based system which will permit surgeons and anesthesiologists to monitor heart functions by using transducers attached to the patient's skin rather than the conventional and more dangerous heart catheter.

The system will monitor systolic time intervals, arterial pressure, carotid pulse, heart tones, temperature, and electrocardiogram.

Driver for the system is a DEC PDP 11/20 computer.

FLORIDA AUTOMATES CLASSROOM SCHEDULE

A classroom scheduling system is now being used at the J. Hillis Miller Health Center of the University of Florida in Gainesville.

The computer reportedly developed the fall quarter schedule for the Colleges of Medicine, Dentistry, Pharmacy, Nursing, Health Related Professions, and basic sciences in 10 seconds, or 43,000 times faster than doing it manually.

About 300 hours of classroom use were scheduled into 13 of 16 available rooms without conflict.

The task previously required up to three weeks to perform on a manual basis.

PATIENT RECORD NEEDS AUTOMATING

Edward Kirby, a staff consultant with International Management Services (IMS), says that medical records are a drawback to the automation of medical information systems. It is recognized that fast retrieval of patient records is important to efficient delivery of care. The computer is not the problem but there is a lack of agreement on how the necessary information can best be displayed.

Basically, there are two factions in the controversy: (1) the patient oriented record, and (2) the problem oriented record. Both are in widespread use. Jirby thinks an effective combination of the two my be the eventual outcome.

Most hospitals have developed systems according to their own needs. Such systems are rarely installed at other sites, so there is a redundancy of development effort.

BIOMEDICAL NEEDS CLIMB SHARPLY

Morton Schwartz of California State University says that the market for biomedical equipment and instruments will climb very steeply in the next few years.

The cost of medical equipment used in hospitals in 1964 was about $600 million. By 1974, this had reached $2.5 billion, and is expected to reach $6.3 billion by 1984.

Over 1,000 companies are now producing instruments for the medical industry. New companies will enter the market as the demand rises.

Engineers are now being specifically being trained for careers in health engineering. This includes bioengineering (supporting inquiry into biological systems), medical engineering to support diagnostic and therapeutic devices and artificial organs, and clinical engineering which applies to improvement of delivery systems.

'Wired City' Planned in Japan

The "wired city" concept will be inaugurated on a test basis in Tokyo in November. The system will consist of an interactive, computer-controlled video education and information link. After the test in Tokyo, the system will be moved to Higashi Ikoma near Osaka where 300 homes will be wired into the system.

The system will include TV programs on request, data and facsimile transmission, bill-paying, shopping, computer-assisted instruction, reservations, burglar alarms, fire alarms, and remote meter reading.

Implementation has been delayed because the use of coaxial cable as originally planned was too expensive. Fiber optics will be used instead.

Each home will have a transmitting channel and a receiveing channel for analog and digital signals.

PULMONARY FUNCTION ANALYZER DEVELOPED

A low cost pulmonary function analyzer has been developed, using microprocessor technology.

Capacity readings and flow rates are measured. Immediate printout is available.

The system includes a Micro 68 computer, 16 K bytes of storage, a Floppy Disk, cathode ray terminal, printer and analog to digital converter.

Other programs will be added at a later date, including blood gas analysis. The unit may be purchased for less than $10,000 from Electronic Products Associates, 1157 Vega Street, San Diego, CA 92110.

CLINIC MANAGEMENT SYSTEM OFFERED

Professional Hospital Services, the marketing division of American Medical International, has offered their hospital management system to outsiders. The system has already been installed at 25 of the hospitals operated by the firm.

The system, called Patcom, runs on an IBM System/32, with some processing done by a service bureau. Daily, weekly, and monthly reports are produced on patient, bed, and financial status. Also, there is analysis of revenue, service usage, and doctor utilization. Cost runs about $1 per patient day.

The firm is located at 414 North Camden Drive, Beverly Hills, CA.

SERIALS DATA SYSTEM ORGANIZED

UNESCO and the International Council of Scientific Unions has set up the International Serials Data System (ISDS), a registry for Scientific Periodicals.

ISDS was originally established in 1970 in Paris, with funding from the French Government and UNESCO.

The system is based on the voluntary cooperation of libraries, publishers, and organizations. The center will compile a file of serials from all participating regions and countries. It will also coordinate the work of regional and national centers.

Micros replace Minis in Medical Applications

MICROS INVADE MEDICINE

The invasion of the microcomputer into medicine is underway, according an article in Computer Decisions (Oct. 76, p.14).

Since heart pacemakers must work continuously under a variety of conditions, their reliability and performance is critical. Researchers at St. Mary's Medical Center in Long Beach, California are analyzing the performance of pacemakers by interfacing a Cincinnati Milacron minicomputer with 16K of core to a pacemaker data collection system.

Pulse rate, spike-to-spike interval, pulse amplitude, pulse interval, pulse width at the trailing edge, and other parameters are fed to the computer which then generates a report that compares current performance with stored norms. Distorted waveforms are also detected; these are significant in predicting pacemaker failure.

Martin Graham, professor of electrical engineering at the University of California at Berkeley, is using a microprocessor to monitor electrocardiogram and blood pressure signals. The system monitors the EKG continuously for up to 24 hours with periodic checks of blood pressure. Exception reporting is done when deviations are noted. Irregular or premature heartbeats are recorded along with several subsequent beats. In that way, the amount of data that is stored is substantially reduced.

An algorithm involving a fast Fourier Transform is used to detect shifts in the spectral content of the audible sounds that characterize the diastolic and systolic pressures.

Comparison of current frequency spectra with previous ones enables determination of blood pressure.

Beckman Instruments has designed a micro-controlled analyzer that calibrates blood gas analyzers, relieving technicians of the very tedious task of calibrating the instrument before and after each measurement.

An Intel 8008 microprocessor has been linked to a mass spectrometer to provide an automated drug detector in overdose cases where the physician must know the drug involved very quickly. The detector is known as Olfax and was designed by Universal Monitor Corporation of Pasadena, California.

Honeywell Medical Systems of Hopkins, Minnesota has developed a 8008 based system for the automated scanning of hematological materials. The system performs differential white blood cell counts. A microprocessor, a microscope, and a color TV monitor are linked in such as way that the operator can locate and focus on a cell, then push a button to identify it while the microprocessor keeps track of the groups and does a count.

Puritan-Bennett of Kansas City, Missouri has developed a respiration measuring device called Remac, which has a 4-bit microprocessor at its heart. Standard values for age, sex, weight, and height are compared with values input when the patient breathes into the device, calculations are made and a percent of the normal data is output.

Microprocessors are replacing minicomputers in many applications. More often, the microprocessor is entering into new applications which up until now were not economically feasible.

OR Journal issue on Health

The September-October issue of Operations Research, the Journal of the Operations Research Society of America, is devoted to Health Care in recognition of the increasing importance of operations research in health.

The volume (24, No. 5) begins by announcing the winner of the $500 cash award for the best paper submitted. The winner was "A Consumer Preference Approach to the Planning of Rural Primary Health-Care Facilities", by Barnett R. Parker of Oakland University in Rochester, Michigan, and V. Srinivasan of Stanford University.

Another outstanding feature of the issue is a bibliography of operations research in health-care systems. This is a compilation of 188 applications of OR techniques to the delivery of health care. The bibliography is an excellent collection although it is incomplete, except for those describing mathematical methods of modeling and solving decision problems that form the core of operations research. Articles dealing with budgeting, forecasting, economic analysis, computer techniques, and traditional statistical techniques were omitted, as were publications in books, technical reports, monographs, and convention proceedings.

Four of the articles in the bibliography are readily identified as dealing with dentistry. They are: Hirsch and Killingsworth, "A new framework for projecting dental manpower requirements", Inquiry 12: 126-142 (1975), Kilpatrick et al, "Expanded - function auxiliaries in general dentistry: a computer simulation", Health Serv. Res. 7:288-300 (1972), Lipscomb and Sheffler, "Impact of Expanded-duty assistants on cost and productivity in dental care delivery", Health Serv. Res. 10:14-35 (1975), and Pelton et al, "Comparison of computer-generated data with actual use of therapists", J. Dent. Educ. 37: 21-25 (1973).

The rest of the volume is taken up by 11 of the 70 articles submitted for the competition. None of the 11 articles published deal with dental problems.

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CYBER-MEETINGS

December 8-10, 1976: ADVANCES IN MEDICAL SYSTEMS in Miami. Contact: Fletcher W. Donaldson, University of Tennessee Space Institute, Tullahoma, TN 37388.

December 13-15, 1976: SEVENTH ANNUAL CONGRESS ON ADVANCES IN AUTOMATED ANALYSIS AND INFORMATION SYSTEMS in New York. Contact: Technicon Corp., Tarrytown, NY 10591.

January 5-7, 1977: INTERNATIONAL CONFERENCE ON SYSTEM SCIENCES in Honolulu. Contact: Rahul Chattergy, Dept. of Electrical Engineering, Univ. of Hawaii, Honolulu, HI 96822.

January 24-26, 1977: CONFERENCE ON DECISION SUPPORT SYSTEMS in San Jose. Contact: Eric D. Sloan, IBM Research Lab, K54/282, 5600 Cottle Road, San Jose, CA 95193.

January 27-31, 1977: AMERICAN MATHEMATICAL SOCIETY in St. Louis. Contact: AMS, P O Box 6248, Providence, RI 02940.

January 31-February 2, 1977: COMPUTER SCIENCE CONFERENCE 77 in Atlanta. Contact: Vladimar Slamecka, School of Information and Computer Science, Georgia Institute of Technology, Atlanta, GA 30332.

February 2-3, 1977: SYMPOSIUM ON COMPUTER SCIENCE AND EDUCATION in Atlanta. Contact: J. Goda, School of Information and Computer Science, Georgia Institute of Technology, Atlanta, GA 30332.

February 7-11, 1977: CONFERENCE ON IMPROVING THE PERFORMANCE OF THE HEALTH SYSTEM in St. Petersburg, FL. Contact: Dept. of Industrial Engineering, Wayne State University, Detroit, MI 48202.

February 24-25, 1977: SYMPOSIUM ON DESIGN AUTOMATION AND MICROPROCESSORS in Palo Alto, CA. Contact: W. M. vanCleemput, Digital Systems Lab, Stanford University, Stanford, CA 94305.

CYBER-BOOKS

The Health Applications Section of the Operations Research Society has three books that are offered for $1.00 to new or recently renewed members. The books are: "Systems Approaches to Environmental Pollution", "Alternative Approaches to National Delivery of Health Care", and "An International Conference on Health Care Technology Systems". Send evidence of your renewal or initiation of membership, $1.00, and your choice of books to: William W. Walton, Jr., 10424 Windsor View Drive, Potomac, MD 20854.

March 13-17, 1977: ASSOCIATION FOR THE ADVANCEMENT OF MEDICAL INSTRUMENTATION in San Francisco. Contact: AAMI, 1901 N. Ft. Myer Dr., Suite 602, Arlington, VA 22209.

March 22-25, 1977: MEDICAL DATA PROCESSING SYMPOSIUM in Toulouse, France. Contact: Conference Secretariat, IRIA, Domaine de Voluceau, 78150 Le Chesnay, France.

March 28-30, 1977: SYMPOSIUM ON LANGUAGE DESIGN FOR RELIABLE SOFTWARE in Raleigh/Durham/Chapel Hill, NC. Contact: Robert M. Graham, Dept. of Computer and Information Science, Graduate Research Center, University of Massachusetts, Amhherst, MA 01002.

May 9-11, 1977: TIMS/ORSA (THE INSTITUTE OF MANAGEMENT SCIENCES/OPERATIONS RESEARCH SOCIETY OF AMERICA) in San Francisco. Contact: David Schrady (Code 05), Naval Postgraduate School, Monterey, CA 93940.

June 13-16, 1977: NATIONAL COMPUTER COMFERENCE in Dallas. Contact: Karen Duncan, College of Dental Medicine, Medical University of South Carolina, 80 Barre Street, Charleston, SC 29401.

August 8-13, 1977: MEDINFO 77 - SECOND INTERNATIONAL CONFERENCE ON MEDICAL INFORMATION SYSTEMS in Toronto. Contact: J. F. Brandejs, Box 8650, Ottawa, Ontario K1G 0G8, or Dr. D. Lindberg, Lewis Hall, School of Medicine, University of Missouri, Columbia, MO 65201.

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